

# N1™ Grid Service Provisioning System

Managing Complexity: The Need for Intelligent Automation in Application Deployments



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## Chapter 1

# Executive Summary

Cutting costs, boosting efficiencies, and meeting the rising expectations of customers are common yet critical business challenges. To address these challenges, today's businesses are moving more operations online and increasing their dependence on Web applications.

Technical advances and rapidly evolving business requirements keep these applications in a constant state of flux. To host these applications, businesses have established large data centers, which have grown increasingly complex and sophisticated given the relentless pace of change. Data center professionals tasked with ensuring that applications are up, running, and in line with business processes lack a comprehensive solution that would enable them to deploy, modify, and fine-tune applications accurately and reliably.

While software engineers have sophisticated tools for developing and testing software applications, operations professionals must still configure and deploy applications manually with a collection of custom scripts and low-level commands. As a result, the process of changing mission-critical applications is error-prone, chaotic, and needlessly time-consuming. In fact, for many organizations, unsuccessful changes to applications are the leading cause of application downtime.

IT organizations have three choices for responding to the complexity inherent in configuring, deploying, and modifying applications. First, they can attempt to reduce complexity by standardizing hardware and software. Unfortunately, replacing existing systems is expensive, and standardization is difficult to accomplish across all business units.

*For the growing number of businesses that are moving their operations online, automated software tools may be the most viable solution for dealing with the increasing complexity of configuring and deploying Web applications.*

Second, they can increase their staff to cope with the greater workload — another expensive proposition that introduces problems of its own, such as those inherent in coordinating a large team.

Third, they can adopt a comprehensive software system for application configuration and deployment. This software systematically automates the configuration, deployment, and analysis of applications. Following this approach — intelligent application deployment — IT organizations can:

- Automate formerly manual deployment processes, accelerating time to market for key applications and eliminating operator error
- Perform rapid root-cause analysis when something goes wrong, significantly reducing application downtime
- Capture every change made to every server, providing complete visibility into and control over the application environment

The N1™ Grid Service Provisioning System enables customers to automate the configuration and deployment of applications from a central console, making configuring and deploying applications faster, simpler, and more reliable.

## **About N1 Grid Technology**

N1 Grid technology is Sun's architecture, products, and services for the next-generation data center. It addresses the many problems that have to date hampered organizations in delivering true, just-in-time computing. N1 Grid technology is designed to reduce management complexity and cost, increase data center resource utilization, and improve infrastructure responsiveness and agility.

The N1 Grid Service Provisioning System, an important element of the N1 Grid portfolio, delivers on the second phase of N1 Grid technology by rolling out complex services rapidly — reducing time to deployment and increasing application uptime by eliminating errors.

To learn more about Sun's revolutionary N1 Grid architecture, products, and services, please visit [sun.com/n1](http://sun.com/n1).

## Chapter 2

# The Growing Importance of Web Applications

### Application-Centric Business

In every industry, business is moving online. After migrating business information to databases in the 1980s and setting up e-commerce applications in the 1990s, organizations of all sizes are relying on Web applications for core business operations.

Increasingly, business itself — the interaction between a company and its customers, partners, and employees — is taking place through Internet software and data center applications.

- Customers make purchases, monitor orders, and interact with customer service online.
- Businesses communicate with partners over extranets, virtual private networks (VPNs), and personalized Web portals. Online presentations and Web seminars complement conference calls.
- E-mail has eclipsed the telephone and fax machine as the primary channel for business communications.<sup>1</sup> Customers submit e-mail inquiries and Web forms to applications integrated with business Web sites.
- Customer relationship management (CRM) and enterprise resource planning (ERP) solutions bring coherence and efficiency to diverse business operations by linking applications among business units and creating new channels for communication.
- Intranets continue to grow in importance and sophistication. Intranet applications now support a broad range of HR services, corporate knowledge management, and other internal functions.

These trends are reinforcing each other. For instance, e-commerce applications are extending the functions of Web applications to give the customer unprecedented access to the business. The more often a customer places orders on a Web site, the more likely that customer is to return to the site to check on order status, send e-mail to customer service, forward items to interested friends, and so on. Business users and consumers alike are doing more and more online — and expecting that applications will be available to serve them anytime, anywhere.

Applications are no longer merely tools for supporting operations; they have become the engines for business operations themselves. As Gartner says, “Information technology often is the business process.”<sup>2</sup>

1. META Group, Mail Policy Management: A 21st Century Business Imperative, 2001.

2. Gartner, CIO and CIO Alert: E-Business Is Changing the Dynamics of the Business Continuity Market, June 14, 2000.

## Life on the Edge: Real-World Application Deployments

Given the mission-critical nature of today's applications, it is reasonable to assume that IT organizations would be allotted the time and resources to develop careful methodologies for configuring, changing, and deploying applications, and that application rollouts would be undertaken cautiously with nothing left to chance. In fact, as most operations managers can attest, application changes are frequently high-pressure, hectic ordeals, involving custom-built scripts — some written only moments before they are first used, and reflecting best guesses about hardware and software configurations and remote locations. Changes can involve complex combinations of commercial software, in-house applications, and custom code. IT staff are responsible for understanding the requirements for all these components, deploying them quickly and flawlessly with the simple commands and scripts at their disposal, and remembering what they have done at a detailed level.

Applications — already under strain from complex configurations, fluctuating workloads, and security threats — are most vulnerable during deployments and upgrades. A major cause of self-inflicted downtime is inefficiency in the rollout process. During this process, data center staff must use a haphazard collection of tools and incomplete information to safely make the transition from one configuration to another. Staff must also keep track of many factors, including:

- Current configuration of the hardware and software
- Changes that need to be made to hardware and software, affecting the deployment
- Interdependencies of the new hardware and software
- Routing and content details for successful transmission and installation of the application's components
- The new configuration that, once deployed, will serve as the foundation for future changes, including patches, rollbacks, and more

*As more organizations rely on complex Web applications for mission-critical operations, the negative business impact of application outages and failures is becoming increasingly evident and alarming.*

Considering the vast number of variables that need to be tracked and the hurried conditions of the typical deployment, it is no wonder that software changes sometimes lead to disastrous service outages, and that 40 percent of application downtime is due to operator errors.<sup>3</sup> Given the imperfect information available to data center staff, relentless requests for system modifications, and complexity of application operating environments, it is not surprising that software upgrades and deployments sometimes fail. What is becoming increasingly noticeable and alarming, however, is the business impact of these failures.

Consider the following examples from a Gartner study.<sup>4</sup>

3. Gartner, *ibidem*.

4. Gartner, *op cit*.

## Lost Revenue

When systems failed during an application rollout in September 1999 at Hershey Foods, the costs were substantial. The company was forced to delay shipments and suffered a 12-percent decrease in third quarter sales. Net income for the quarter dropped 19 percent compared to the third quarter of the previous year.

Application outages can reduce revenue in a number of ways, such as:

- Shutting down e-commerce applications
- Depriving operations staff of the logistics information they need to ship and receive products
- Bringing down systems needed to process transactions
- Bringing down Web sites whose page views drive advertising revenue
- Frustrating customers, who then take their business to competitors

## Increased Costs and Increased Regulation

Some application outages are so severe that companies are forced to offer rebates, slash prices, or create other incentives to keep customers. As a result of outages in 1998 that lasted between six and 26 hours, AT&T was compelled to offer customers \$40 million in rebates. In addition, the company was forced to file service-level agreements (formal agreements with measurable commitments for service) with the Federal Communications Commission (FCC). Another telecommunications giant, MCI, encountered software upgrade problems in 1999 and ended up offering 20 days' free service to 3000 businesses.

Application outages can increase costs and incur regulatory scrutiny by:

- Forcing business units to work without automation, slowly and laboriously doing the work normally handled by applications
- Requiring work to be repeated or repaired
- Depriving customers of a service, such as access to financial accounts or trading functions, that regulatory agencies consider essential

## Chapter 3

# Problems With Deploying Applications

### Lack of Appropriate Technology

Operations teams must rely on homegrown scripts and techniques — typically developed by IT engineers on an as-needed basis — to configure, deploy, and upgrade applications. While this patchwork of tools may have been sufficient for managing a small number of devices and servers in a static environment, it is woefully inadequate for handling today's large, dynamic networks and data centers.

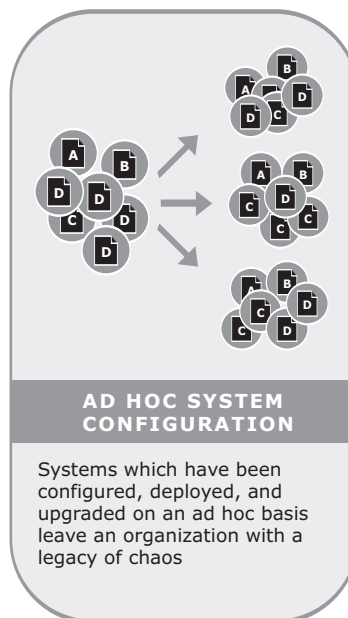


Figure 3-1. Ad hoc system configuration.

*Without tools that treat applications as applications, IT organizations have no way to easily and accurately model the configurations and interactions of applications, and no way to define and enforce policies for applications.*

The size and complexity of today's data centers lie beyond the scope of custom scripting. There are simply too many variables for even the best-intentioned script writers to track. When employees have too much to remember, this can lead to problems. Large IT organizations are responsible for thousands of systems that have been configured, deployed, and upgraded on an ad hoc basis. The result is a legacy of chaos. An IDC white paper relates the experience of an information security executive who found that "his organization had 200-plus machines on the Internet, each one configured differently than the rest. The machines that were created with variations also were not properly maintained." This executive's conclusion: "The machines weren't really ours anymore."<sup>5</sup>

IT organizations lack any kind of system for automatically and reliably assessing the configurations of data center applications or for changing those configurations to comply with approved policies and models. Without such a system, data center operations professionals are swamped with work and struggle to understand, let alone manage or proactively plan, the deployments for which they are responsible.

## Inability to Manage Applications as Applications

Business units purchase or design applications and expect IT organizations to deploy and maintain them. But the scripts and basic file transfer commands available to IT organizations provide no means of treating applications as anything other than aggregations of files. Without tools that treat applications as applications, IT organizations have no way to easily and accurately model the configurations and interactions of applications, and no way to define or enforce policies for applications.

## Lack of In-Depth Reporting and Analysis

When an application outage occurs, data center professionals must sort through log files, handwritten notes, and miscellaneous system files to determine what went wrong and how to fix it. As a result, outages last longer than they would have if operators had ready access to comprehensive configuration data.

To master — and make sense of — all the details involved in an application deployment or upgrade, data center teams need analysis tools that are:

- Thorough enough to provide all the relevant details about system requirements, including known incompatibilities and current configurations
- Consistent (and consistently applied) throughout a data center or group of data centers
- Capable of warning data center staff about configuration errors such as software incompatibilities before applications are deployed
- Capable of providing the high-level information about application configurations and performance that business units might request

IT organizations and business units alike need a centralized console for viewing, assessing, and managing applications.

5. IDC, Data and Network Integrity (DNI), May 2001.

## **Lack of Transferable Knowledge and Consistent Procedures**

Deployment and upgrade scripts are usually poorly documented — if they are documented at all — and the knowledge about how to use them typically departs with their authors. To properly use the few tools they have, IT teams must count on unrealistically low personnel turnover.

Furthermore, one data center's procedures and deployment best practices may be completely unknown to other data centers in the same organization. With no easy way to share information, multiple data centers or teams within a single data center may develop conflicting methodologies and tools. This problem becomes particularly acute in the case of a merger or acquisition.

## **A Reactive, Rather Than Proactive, Environment**

When a business unit requests that an application be deployed, the data center operations team creates installation scripts, transfers files, and fixes problems as quickly as possible. These functions are highly manual, tedious, and time-consuming. At every step, the team is reacting rather than planning and proceeding in a proactive manner.

Without a centralized system for configuring and deploying applications and with no information captured on best practices as a template for future deployments, data center teams will never be able to break out of this vicious cycle.

## Chapter 4

# Responding to Change and Complexity

Faced with increasingly application-reliant business operations, IT professionals desperately need a solution for systematically managing the change and complexity of data centers. IT organizations can respond in one of three ways:

- **Standardization:** To minimize complexity, they can standardize on a single family of hardware and software solutions.
- **Staffing:** They can continually grow their staff.
- **Technology:** They can deploy software that systematically automates the configuration, deployment, modification, and analysis of applications.

### Reducing Complexity Through Standardization

One of the surest ways to decrease complexity is through standardization. By standardizing on a single computing platform, such as the Solaris™ Operating System (OS), data center professionals can simplify their work and reduce employee education, custom development, and support overhead. IT organizations can also standardize on software suites from a single manufacturer, such as SAP, Oracle, or PeopleSoft, further reducing the complexity of their data center operations.

Experience has shown, however, that standardization is easier to preach than to practice. There are several reasons for this.

First, because most businesses have already invested in multiple computing platforms and software applications, replacing working systems in the name of standardization would be too costly and time-consuming.

Second, business units and their development teams like to choose the applications and platforms that best fit their business needs. If a finance department wants an accounting system that runs best on one platform, and a sales department wants a lead-tracking system that runs on another, the IT organization may not be able to persuade either department to abandon its choice.

Third, even if an organization succeeds in standardizing its hardware and software systems, business activities such as mergers and acquisitions or partnerships may force it to once again adopt a heterogeneous environment. Therefore, despite the best intentions of IT managers, it is very rare to find an organization that is not supporting multiple platforms.

## Increasing Capabilities Through Staffing

As the need for better application configuration and deployment increases, an IT organization can respond by simply hiring more data center employees. In effect, adding employees adds more custom scripts as well as eyes and hands to perform tasks such as configuring, changing, and monitoring applications.

For many organizations, this choice is not viable. Faced with a slowing economy, businesses are more typically asking their IT organizations to make do with existing data center staff or with a smaller one. Even for IT organizations that have adequate finances, a hiring strategy is impractical. Adding employees actually increases complexity by boosting demands for equipment, training, and management. Nor does adding staff address the need for improved administrative tools or reduce the chances that operator error will result in suboptimal application performance or application downtime.

## Managing Change Through Automated Technology

A third choice for IT departments is to adopt application deployment software — technology that enables data center teams to deploy applications systematically. This software provides:

- Controls for mapping business processes to server and network configurations
- An object model for managing applications directly and consistently
- Centralized control and global enforcement of application policies
- Enterprise-wide visibility of all application deployments through reporting and audit trails

Instead of relying on custom scripts and low-level commands to perform essential services, IT organizations can trust configurations and deployments to a comprehensive, policy-based system — deployed across all data centers — that automates and error-checks their work.

This solution relieves data center teams of mundane, repetitive, and error-prone tasks. It also enables them to concentrate on the bigger issues, such as system integrity and how the network and applications can best be configured and deployed to meet business needs.

## Chapter 5

# Intelligent Application Deployment Software

To manage change and complexity in data centers, IT organizations need accurate, timely information about tens of thousands of files on thousands of systems. They need information about the changes that have been made to those files as well as the changes that should be made to restore the integrity of the supported applications.

In short, managing applications requires application intelligence — the systematic collection and use of information for tracking and effecting changes in applications. We call this approach “intelligent application deployment.”

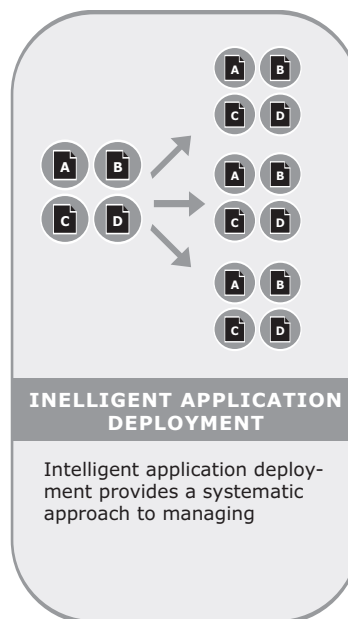


Figure 5-1. Intelligent application deployment.

*Intelligent application deployment software can provide organizations with access to timely, accurate information about applications and configurations, thereby speeding problem identification and analysis, reducing downtime, and maintaining the infrastructure integrity that assures reliable performance.*

## Requirements for Intelligent Application Deployment

### The Object Model: Replacing Chaos With Order

Bringing intelligence and systemization to the problem of configuring and deploying applications requires IT organizations to amass, categorize, and make sense of vast amounts of information. The information must also be complete; otherwise, important configuration details might be overlooked. But simply presenting data center operators with reams of information does not make their work any easier — on the contrary. That's why information must be presented in an economical, readily intelligible way — a way that gives data center staff the tools they need to take action confidently and effectively.

Intelligent application deployment provides IT operators with a systematic approach for rolling out applications by introducing an object model for applications and making this object model actionable.

What is an object model for applications? It is a formal record of an application's desired configuration that takes into account business goals, hardware and software requirements, and interapplication dependencies. The object model brings together the expertise of application developers, software manufacturers, quality assurance (QA) engineers, and data center operators, and ensures that this expertise is put into practice whenever an application is deployed or modified.

Adopting an object model transforms an application from a poorly understood collection of files into a distinct object that can be manipulated. Using object models, data center operators can rigorously define applications, quickly compare configurations running on different systems, and instantly identify incompatibilities and problems. Object models provide data center operators with a long-sought-after, high-level system for automating the low-level details of data center operations.

## Benefits of an Object Model for Applications

### Planning, Policies, and Best Practices

Once data center managers are able to view applications as distinct objects, they can establish policies for them, and using automated deployment software, manage them with the same control and consistency with which they manage other important assets, such as databases and firewalls. Object models enable data center managers to set policies for:

- **Configurations:** They can define a standard configuration for an application and ensure that this configuration is used consistently in every data center throughout the organization.
- **Change Procedures:** They can define step-by-step procedures for deploying or changing applications, assign specific roles to operators and ensure that only authorized users perform certain functions, and block unauthorized changes to applications.
- **System Analysis:** They can define policies for periodically scanning data center networks to identify any rogue modifications made to systems. Errors and unauthorized changes can be quickly corrected through automated procedures based on object models.

Policies can be fine-tuned to incorporate the latest information about software dependencies and change procedures. With complete, accurate information about system configurations, and with automated deployment software for rapidly effecting changes throughout their data centers, IT organizations can develop best practices for application deployments.

## Centralization and Version Control

Like other data objects, application models can be stored in a central repository, annotated, compared, and retrieved as needed. With a central repository for application models, data center operators can:

- **Track Changes:** All the changes made to a particular host or application are recorded.
- **Compare Configurations:** Two different configurations in an application's history — for example, the configuration of a CRM system today and the configuration of the same system two months ago — can be compared.
- **Ensure Consistency:** All data centers use a common source of information about applications.

A central repository of application data promotes consistency and ensures that data center operators always have access to the configuration information they need.

## Global Visibility

A complete, intelligent application deployment software system with a central administrative console provides operations managers with an unprecedented global view of the applications throughout all their data centers. Staff gain access not only to the low-level reports that monitoring systems typically provide, but also to high-level information about applications as a whole. This higher level information provides the business an operational context that has been missing from low-level alerts and error messages. For example, this information enables operations professionals to quickly determine that a specific CRM application is misconfigured, not merely that there is a problem with a network card. By checking the application deployment against information about its ideal state, the operations manager can identify which files need to be changed to correct the problem. Better yet, these changes can be made automatically.

## Reduced Downtime

Intelligent application deployment dramatically reduces application downtime through automation, simulation testing, and reporting that improves application visibility and root-cause analysis.

- **Automation:** The application deployment software delivers powerful, automated tools that replace the error-prone manual steps and custom scripts upon which data center operators currently rely. The software reduces complex, multistep processes to simple commands, and changes application rollouts from chaotic “mad dashes” to logical, brief procedures.
- **Simulation Testing:** By providing extensive information about configurations, dependencies, and conflicts, the software enables data center operators to simulate application changes before actually rolling them out. It systematically identifies conflicts and alerts operations to any problems — before they affect live applications.
- **Rapid Root-Cause Analysis:** When a problem occurs at a data center today, staff must first review configuration records and procedures to determine what went wrong. This analysis, which includes a fair amount of guesswork, inevitably takes time. In many data centers, employees spend hours trying to find the causes of problems. By maintaining a record of all the changes made to every server, intelligent application deployment software greatly accelerates this root-cause analysis. Problems can be identified quickly and corrective steps taken.

## Infrastructure Integrity

The goal of intelligent application deployment is infrastructure integrity — the assurance that all software and hardware components in a system are in a *good state*. Only when applications are in a good state can they securely and reliably perform the services expected of them.

Achieving infrastructure integrity involves establishing a baseline of the known or desired state for any object (such as an application) and then making periodic comparisons between the current state and the baseline. When an object is found to differ from its baseline, the IT organization can take steps to correct the discrepancy, restoring the object's integrity.<sup>6</sup> This baseline is dynamic, moving in accordance with new business models and initiatives on the one hand and with new technology, such as upgrades and patches, on the other. But even as it shifts, it continues to guide data center organizations by providing specific goals for the configuration and functionality of applications.

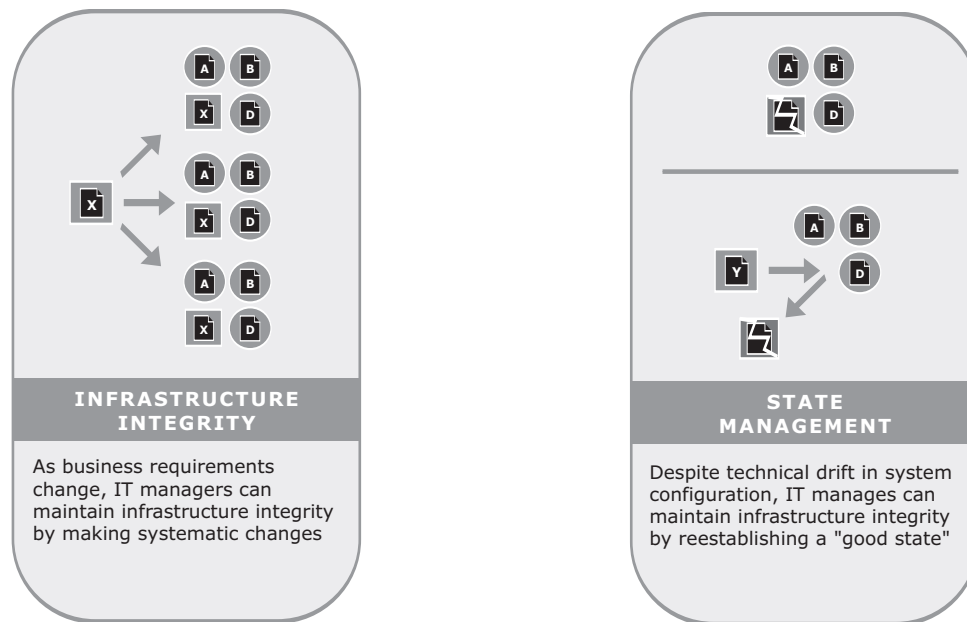


Figure 5-2. Infrastructure integrity and state management.

By automating the deployment, configuration, and analysis of applications, and providing object models with all the information needed to establish an application's good state, intelligent application configuration and deployment software enables data center teams to achieve infrastructure integrity.

Using sophisticated modeling, automated procedures, and detailed configuration analysis, data center operations can:

- Develop and refine detailed application management policies based on business needs; these policies, which specify the desired configurations for applications, serve as an actionable model for infrastructure integrity.
- Upgrade the configurations to meet new business requirements as needed, thereby restoring infrastructure integrity.
- Correct any configurations that have been compromised by rogue software changes or by software bugs that cause applications to drift from their good state. Making these corrections restores application integrity.

Besides assuring the optimal performance of applications, IT managers have another reason for pursuing infrastructure integrity in their data centers — it is how their performance is assessed. As IDC notes: “The degree of infrastructure integrity is directly correlated with the degree of confidence an organization has in the IT organization and its leadership.”<sup>7</sup>

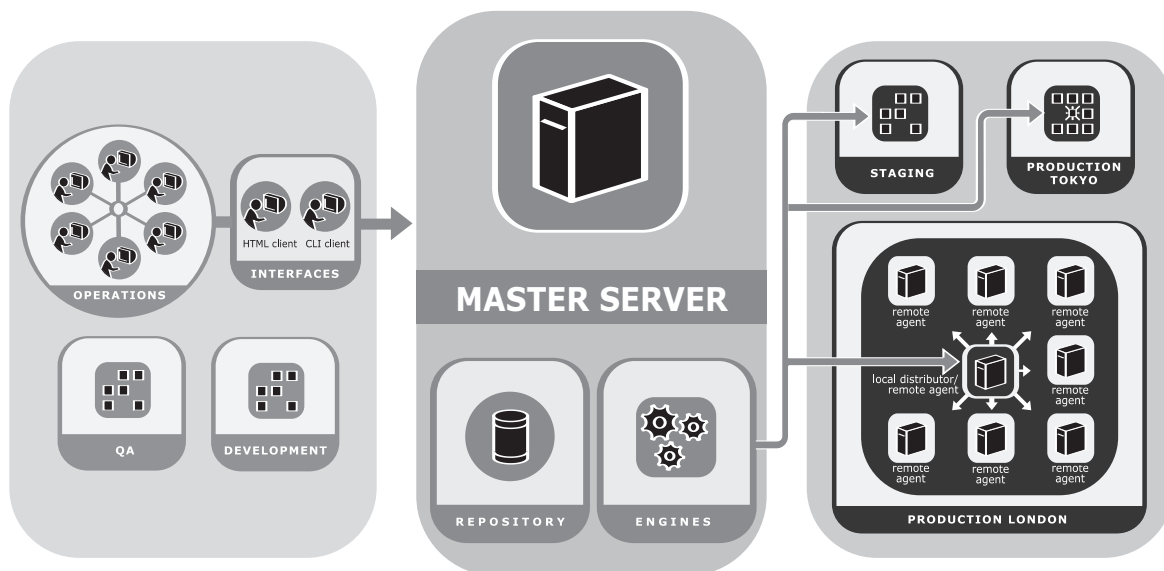
6. IDC, *op cit.*

7. IDC, *ibidem.*

## Chapter 6

# The N1 Grid Service Provisioning System Solution for Intelligent Automation of Application Deployment

The N1 Grid Service Provisioning System is a software product that enables customers to automate the configuration and deployment of Web applications from a central console, making configuring and deploying these applications faster, simpler, and more reliable.



*Figure 6-1. The N1 Grid Service Provisioning System server bridges the gap between software development QA organizations and distributed production data centers by using a series of engines to make all changes to production hosts, and using its repository to track and version all the changes it makes.*

## Modeling Applications to Achieve Integrity

Using the N1 Grid Service Provisioning System, data center professionals can capture vital information about applications in object models and act on that information consistently and efficiently using automated procedures. Data center operations can continuously refine these object models as they learn more about particular applications and business objectives change. This growing body of application expertise is leveraged every time an operator in any data center uses the N1 Grid Service Provisioning System to perform an operation.

### The Environment

The N1 Grid Service Provisioning System server bridges the gap between software development QA organizations and distributed production data centers by using a series of engines to make all changes to production hosts and using its repository to track and version all the changes it makes.

To accelerate implementations of the N1 Grid Service Provisioning System for data centers, the product comes with object models for the most popular Web technologies in use today. These object models provide IT organizations with intelligence about interactions and incompatibilities among hardware and software technologies. Rather than being a laundry list of caveats in release notes, this information is in an actionable form — the N1 Grid Service Provisioning System automatically acts on it even if IT operators never acquaint themselves with the details. The N1 Grid Service Provisioning System keeps track of the details, reducing the workload of data center staff and the likelihood of human error.

In addition to providing object models for off-the-shelf technologies, the N1 Grid Service Provisioning System provides templates for developing object models for customized technologies and applications developed in house. As they do for off-the-shelf technologies, object models serve as a central point for aggregating and categorizing information.

The N1 Grid Service Provisioning System is extensible, so data center organizations can manage all of their Web applications, whether purchased off the shelf or developed in house. Using the N1 Grid Service Provisioning System sophisticated software modeling and simulation testing, data center staff can ensure that the technologies in their Web applications are configured to interoperate flawlessly and deliver optimal performance.

## Reducing Errors Through Automated Procedures

The N1 Grid Service Provisioning System offers IT organizations an information repository and centralized controls for changing applications, whether through upgrades or entirely new deployments. From the N1 Grid Service Provisioning System console, data center operators can define policies and procedures for configuring, deploying, and upgrading applications. These procedures can include multistep subprocedures and authorization controls that limit specific actions to specific individuals and error checking.

For example, using the N1 Grid Service Provisioning System, an authorized data center operations professional can automatically remove a cluster of systems from a load balancer, install an application upgrade, restart all the components in the proper sequence, verify the configuration, and return the cluster to an active state.

While monitoring systems are important, they merely identify problems. If the N1 Grid Service Provisioning System or another monitoring system detects a problem with an application, operators can use the N1 Grid Service Provisioning System to fix the problem quickly and reliably.

## Centralizing Controls for Global Operations

The N1 Grid Service Provisioning System is designed to support global IT operations and features a scalable, distributed architecture. Its version control system acts as a central repository for data, policies, and procedures for all the applications under management. The N1 Grid Service Provisioning System console provides a global view of applications — in staging areas as well as production areas — and enables the CIO and IT managers to define top-down policies for managing applications everywhere.

Although the N1 Grid Service Provisioning System is designed to manage global operations, it also solves problems on a smaller scale. A data center organization can begin using the N1 Grid Service Provisioning System to manage a limited set of Web applications — the applications running in a single staging area, for instance — before expanding coverage to other areas and data centers.

Whether running on a single server farm or through an entire organization's data centers, the N1 Grid Service Provisioning System provides data center professionals with a much needed solution for reducing complexity, eliminating errors, and managing change — quickly and reliably.

## Chapter 7

# Conclusion

More than ever before, businesses are relying on their data centers for essential internal and customer-facing services. New application-centric business models have put information technology on the front line. Web applications are the new medium of business, providing the products and services customers need and use while carrying the brand” for the entire organization.

Data center staff members face a daunting challenge. With primitive tools, complex assignments, and increasing workloads, how can they manage the applications that customers, partners, and employees depend on? How can they achieve the infrastructure integrity their business operations require?

Intelligent automation deployment software products such as the N1 Grid Service Provisioning System provide the answer. By enabling data center managers to configure, deploy, and analyze applications from a central console, they enforce organizational best practices and provide the systematic solution that IT organizations need to provide reliable application services for the entire organization.

To learn more about the unique approach of the N1 Grid Service Provisioning System, please visit [sun.com/n1](http://sun.com/n1).

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