



# WHITE PAPER

## **The Economics of IPAM** Reducing Expenses and Boosting Availability with Automated Core Network Services

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# Table of Contents

<b>Table of Contents</b> .....	<b>i</b>
<b>Executive Summary</b> .....	<b>1</b>
<b>Everything Depends Upon the Network</b> .....	<b>1</b>
Legacy Core Network Services Can't Meet Business Needs.....	2
IPAM May Be the Weakest Link.....	4
<b>What's Needed? Highly Resilient and Automated Core Network Services</b> .....	<b>6</b>
<b>Automated IPAM Can Reduce Network Expenses -- Significantly</b> .....	<b>6</b>
<b>The CIO To-Do List</b> .....	<b>8</b>
<b>The Bottom Line</b> .....	<b>8</b>

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# Executive Summary

Each day, more devices, applications, and services are added to enterprise and global IP networks. To manage through this unprecedented growth, organizations large and small are bulking up network switching and routing equipment, but ESG believes that they continue to ignore a critical part of the network infrastructure: namely, core network services like IP Address Management (IPAM), domain name resolution (DNS), IP address assignment (DHCP), and user name and password authentication (RADIUS). ESG believes this could be a significant problem in the future, dramatically affecting a company's bottom line. This paper concludes that:

- **Massive network changes make core network services more complex.** Provisioning new IP devices and changing existing ones has become a real-time, dynamic process. This change exacerbates problems associated with today's manual tasks and basic tools, rendering current solutions obsolete. Without a change, organizations will experience more network downtime and higher costs.
- **IPAM may be the weakest link.** Just as the network is anchored by core network services, core network services are anchored by IPAM, which may be a root cause of lots of network problems. Many sophisticated organizations still depend upon spreadsheets to track their IP number plan or hold data about each IP device. This makes provisioning, changing, and logging IP addresses a series of manual error-prone tasks, which simply can't scale to meet today's business, compliance, or security needs.
- **Organizations need a Core Network Services solution anchored by automated IPAM.** With so many manual processes and technology problems, many IT shops spend about 80% of their operating budget maintaining their current infrastructure—a true waste of precious resources. To modernize the infrastructure while reducing costs, legacy point services must be replaced over time with resilient, integrated services anchored by automated IP address management tools and then centrally managed.
- **Integrated, automated IP can significantly reduce network expenses.** The right solution can deliver real and immediate benefits, sometimes reducing network expenses (capital and operational) by up to 50%. For example, IPAM costs alone can be lowered by more than 80% by significantly reducing the manual labor and policy steps required to assign, monitor, and support IP addresses while improving network availability and making it more capable of alignment with new IT initiatives.

# Everything Depends Upon the Network

As the first decade of the 21<sup>st</sup> century winds down, it is no longer hyperbole to say that IP networks have become the backbone for everything—communications, business applications, entertainment, etc. This statement is backed by solid facts, including:

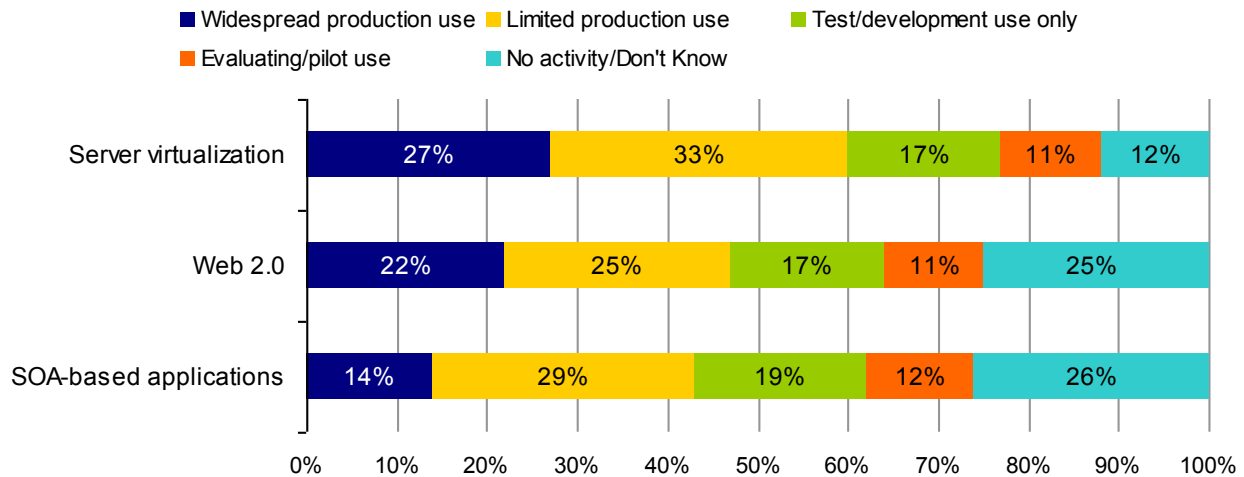
- **Massive growth in IP-based devices.** Over the past few years, traditional PCs and servers have been bombarded by additional IP-based network devices such as smart phones, IP video surveillance cameras, and home gaming devices. For example, the U.S. Centers for Disease Control reports that nearly 18% of American households have moved exclusively to wireless phone services. ESG estimates that network video surveillance equipment sales grew by over 50% in 2008 and expects similar growth in 2009. Finally, industry experts estimate that IP-based consumer electronics shipments exceeded 64 million units in 2007, a year-over-year growth rate of over 70%. The magnitude of this growth is substantial. Recently, Vint Cerf, one of the inventors of the IP protocol, warned that at the current rate of utilization, the 4.2 billion IP addresses available using 32-bit IPv4 will be completely exhausted by 2010.
- **Monumental traffic growth.** While data varies quite a bit, it is safe to say that global Internet traffic continues to grow at an annual rate of between 60% and 100% per year with no end in sight. In some cases, traffic growth remains remarkably high. For example, Switch and Data, announced in November

2008 that traffic at its PAIX public exchange points in New York and Palo Alto grew 112% over the past year. Furthermore, traffic was up 295% at the company's New York network peering center. What is driving this traffic growth? Beyond new users and devices, most experts point to Web 2.0 content like voice and video. It is estimated that the video site YouTube consumed as much bandwidth in 2007 as the entire Internet did in the year 2000.

- More IT initiatives.** According to ESG research, most large enterprise organizations expect continued investment and deployment in network-based IT initiatives such as server virtualization, Web 2.0 applications, and Service Oriented Architecture (see Figure 1). These IT projects are a function of other trends like data center consolidation, IT consumerization, and web-based application standards. Obviously, all of these roads lead back to the Internet. Many of these initiatives involve automation of systems and endpoints (which enable higher velocities of change) and even heavier reliance upon the network itself. Keeping track of IP addresses is destined to become more expensive and yet more strategic as enterprises embrace automation.

**FIGURE 1. IT INITIATIVES LEVERAGE IP NETWORKS**

**To what extent does your organization currently use or plan to implement the following in the next 24 months? (Percent of respondents, N=602)**

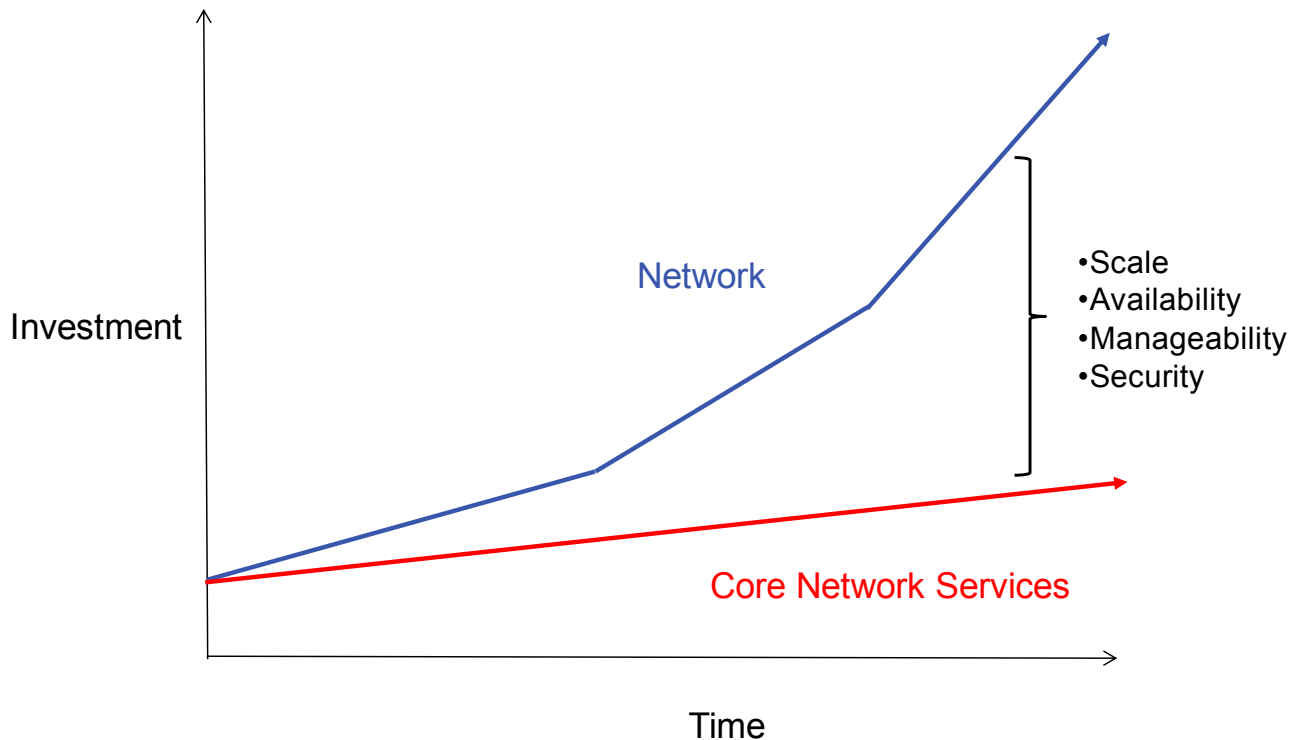


Source: Enterprise Strategy Group, 2009

### Legacy Core Network Services Can't Meet Business Needs

Today's IP networks are built on top of a creaky foundation of manual IP address management (IPAM) and volatile DHCP and DNS systems that has received little attention or investment over the same period of time (see Figure 2). Core network services should be the absolute "latest and greatest" as they serve as the middleware bridge between user devices, business applications, and IP handsets and actual network devices. Yet, these unreliable core network service processes and technologies have created a networking gap that may ultimately undermine the integrity of private IP networks and the Internet itself because of:

FIGURE 2. THE CORE NETWORK SERVICES GAP



Source: Enterprise Strategy Group, 2009

- Cumbersome day-to-day operations.** In most organizations, DNS and DHCP software is simply installed on basic server hardware and standard operating systems like Linux, UNIX, and Windows. In the past, this basic set up was adequate, but no longer. Why? In today's network-centric organizations, network and system administrators struggle to install new systems, patch existing servers, troubleshoot security problems, and maintain peak system performance. Current growth in IP network devices combined with higher velocities of change and escalating traffic volumes will magnify the impact of these already cumbersome problems.
- Unplanned downtime.** Day-to-day administrative attention, configuration errors, and remediating security problems leads to an inevitable consequence, unplanned network outages. This issue is illustrated by ESG research. In a survey of 201 network and system administrators, ESG found that nearly half of all large organizations (i.e., more than 1,000 employees) experienced an unplanned network outage related to DNS within the last year, while 43% said that their organization had experienced an unplanned network outage related to DHCP in the same timeframe. Alarming, this trend is most profound in the largest organizations that theoretically have more IT resources—and the most to lose. ESG research found that while 40% of organizations with less than 5000 employees had experienced a network outage related to DNS, the percentage is much higher in even larger organizations. These types of network outages are far from trivial. Most organizations believe that this type of service interruption carries business ramifications in areas like customer satisfaction, application downtime, and direct loss of revenue (see Figure 3).

**FIGURE 3. BUSINESS IMPACT ASSOCIATED WITH A NETWORK OUTAGE RELATED TO DNS OR DHCP**

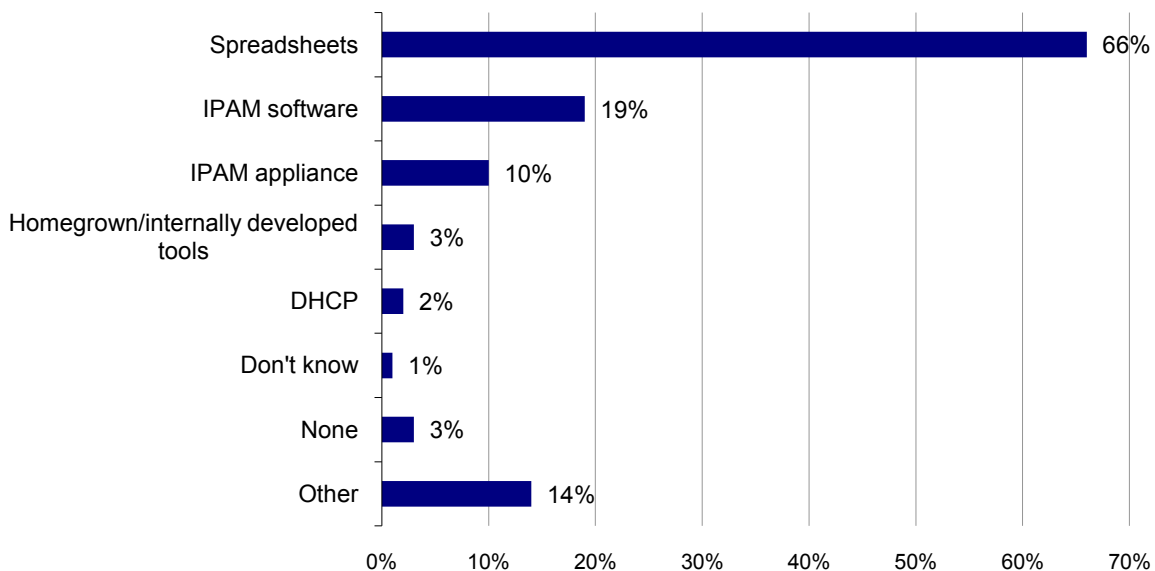
		DNS	DHCP
Suppose your organization were to have an (initial or subsequent) outage related to DNS, DHCP, or RADIUS services in the next 12 months. Given your organization's networking plans and changes, what do you believe are the most likely ramifications of this outage?	Dissatisfied customers	31%	24%
	Application downtime	64%	51%
	Direct loss of revenue	27%	23%

### IPAM May be the Weakest Link

Unfortunately, DNS, DHCP, and RADIUS aren't the only problems with today's network infrastructure. These services depend upon a solid foundation of IPAM for device provisioning, as well as day-to-day moves, adds, and changes. Unfortunately, most organizations still depend upon basic spreadsheets and manual processes for these essential management tasks (see Figure 4). This leads to a series of problems especially worrisome in a dynamic network environment. These issues include:

**FIGURE 4. IPAM TOOLS IN USE TODAY**

Which of the following is your organization using for IP address management? (Percentage of users, N = 206)



SOURCE: ENTERPRISE STRATEGY GROUP, 2009

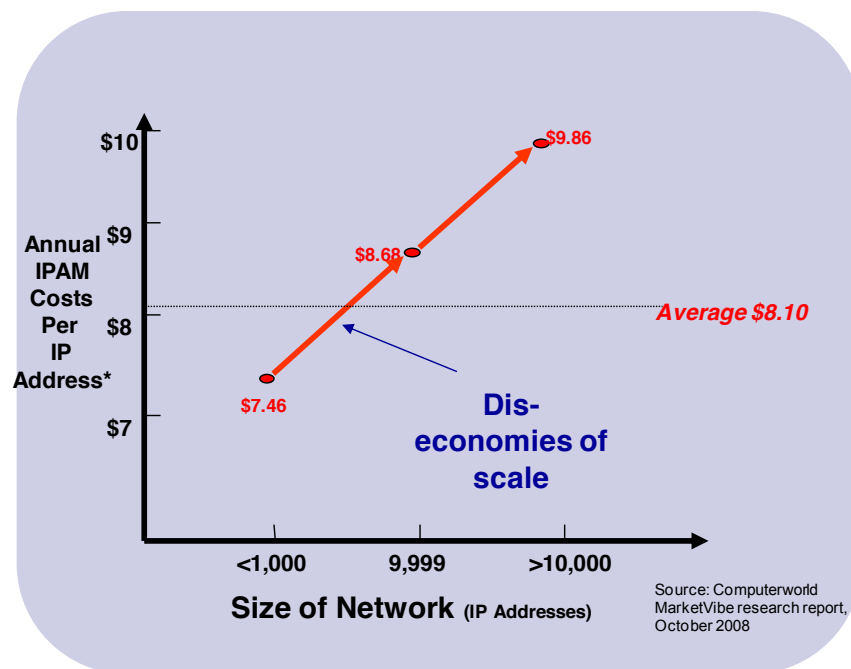
Source: Enterprise Strategy Group, 2009

- Provisioning difficulties.** With manual IPAM processes based upon spreadsheets, it can take hours to find and allocate an available IP address for a new device like a server or printer. This may not seem like much, but multiplied by tens of thousands of devices in a dynamic network setting, it adds up quickly. Manual IPAM also requires time and resources for updating the IP number plan, updating DNS, or adding new IPAM data.

- **A limited audit trail.** IP audit data is essential for network problem isolation, security forensic investigations or regulatory compliance. Unfortunately, manual IPAM audit trails depend upon distributed log files that may need to be reviewed manually by administrators. This makes gathering and analyzing this data cumbersome and time consuming.
- **A pattern of configuration errors.** Manual IPAM often leads to problems such as duplication of IP addresses and, ultimately, network downtime.

Manual IP address management has yet another profound and often ignored ramification: it drives per unit IP address management costs higher as networks grow. According to a recent Computerworld research report, manual IPAM can lead to a dis-economy of scale where it costs incrementally more to manage each IP address as the number of network nodes increases. Certainly, larger networks are more complex, but this type of curve should be troublesome to CIOs (see Figure 5).

**FIGURE 5. DIS-ECONOMY OF SCALE FOR IPAM**



Source: Enterprise Strategy Group, 2009

ESG sees a potential crisis looming. If these problems continued to be ignored, large organizations face an unacceptable situation: increased downtime, additional security events, burdensome operations, and increasing costs, which, in today's economic environment is unacceptable. Clearly, something must be done.

# What's Needed? Highly Resilient and Automated Core Network Services

Rather than rely on half-baked tools, freeware, or operating system add-ons, network-savvy organizations need to bolster core network services in support of their modern network-based business processes. To rise above existing shortcomings, enterprises should look for a core network services solution that:

- **Has automated IPAM for accuracy and process automation.** Start with IPAM to provide a precise database of the existing network infrastructure. With this foundation in place, IT can establish an accurate network map as a baseline, re-assign stale IP addresses, and create a logical list of IP addresses for future use. Additionally, the IPAM database and administrative functionality provides the necessary framework for process automation. These tools can help IT layout a more elegant network segmentation, assign logical IP addresses ranges to different subnets, respond quickly to provisioning requirements, and then update DNS/DHCP changes in real time. All of these moves, adds, and changes will be supported by IPAM-based change management, logging, and historical reports.
- **Is architected as a grid for high availability.** The solution must be architected as a highly available grid of devices that provide network services (i.e., DNS, DHCP, RADIUS, etc.) and share a distributed database. In this way, the grid acts as a superset of individual devices so if one node fails, the rest of the grid immediately picks up the slack. The grid can also re-distribute its workload when a new node is installed or when a failed device comes back online. To increase security and ease operations, the grid should be built on top of a hardened purpose-built operating system rather than a general purpose server OS. Network appliances are a good fit here, but given the rapid deployment of server virtualization technologies for IT optimization, grids should include virtual appliances as well.
- **Ease operations with built-in central management.** In many cases, today's DNS and DHCP servers require custom installation, configuration, and administration on a box-by-box basis. Obviously, this consumes a lot of IT operations time. To streamline these processes, a truly viable core network services solution must provide a central management model. Provisioning a new network, patching systems, or adding a new grid member should take a single trained administrator a matter of minutes rather than require multiple hours of work from a team of network administrators and IT operations staff.

## Automated IPAM Can Reduce Network Expenses—Significantly

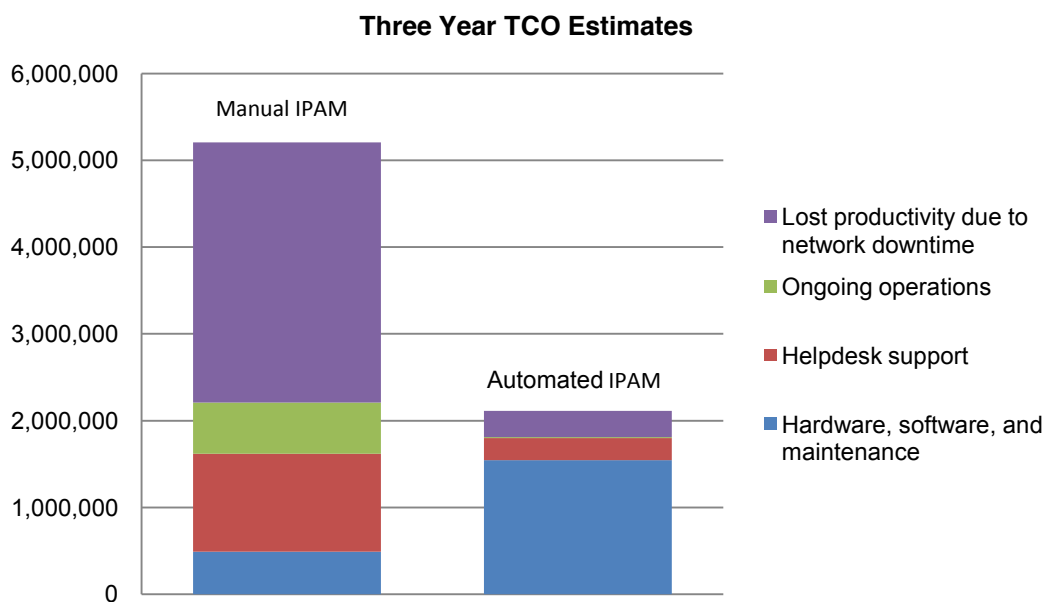
With a global recession casting a large shadow over IT spending, it may be difficult to dedicate budget dollars for core network services projects based upon general assumptions about streamlined IT operations and improved security. With a more detailed analysis, however, ESG believes that automating IP address assignment and integrating IPAM with DNS/DHCP and other core network services can lead to sizable capital and operations cost reductions driven by: server elimination and consolidation and the automation of frequent, error-prone tasks (including IP address and network provisioning, DNS changes, and IP address reclaim, etc.). Smart CIOs can look for real annual savings in areas such as:

- **Eliminating and consolidating servers.** General purpose DNS/DHCP servers can be replaced by dedicated core network services appliances and Microsoft authentication services can be consolidated onto fewer servers in the data center. Those changes could reduce the TCO for core network services by more than 60%, assuming a monthly server TCO of \$1500.

- **Automation of common tasks.** Administrative and operating cost savings can decrease by up to 80% with automated IPAM. There are multiple benefits here including:
  - **IP Address Assignment.** Automated IPAM can unify management through a single GUI used for IP address tracking, provisioning, and auditing. By automating IP address assignment, eliminating manual processes, and reducing configuration errors, CIOs can expect significant cost savings.
  - **Subnet space monitoring.** Rather than relying on spreadsheet lookups and network pings, automated IPAM can prevent IP address fatigue by monitoring IP assignments and using automated e-mails or SNMP alerts when DHCP pools and subnets are oversubscribed.
- **Help desk calls.** As previously mentioned, manual IPAM errors often result in network interruptions which inevitably cause help desk telephones to ring incessantly. To overcome this costly situation, help desk personnel can be provided with access to the automated IPAM system to check for problems before issuing a trouble ticket. Rich IPAM data such as IP address numbers, MAC addresses, host names, and device locations can also streamline network operations processes by providing help desk personnel with the right information to help network engineers isolate—and fix—problems. ESG estimates savings of nearly 80%.
- **User productivity.** By eliminating about 90% of IPAM-related network downtime, CIOs can do more than simply save on IT operations cost, they can actually improve user productivity in the process. This can only increase revenue and reduce costs across the organization.

Based on the reductions in capital and operating expenses, ESG estimates that large organizations can reduce associated expenses by nearly 60% over 3 years. Upfront costs of purchasing automated core network service appliances can quickly be absorbed by savings generated by substantial reductions in capital and operations expenses. The following model assumes an enterprise with four branch offices (and a DNS/DHCP server in each), 10,000 total IP addresses and a pair of servers for external DNS (see Figure 6).

**FIGURE 6. COST SAVINGS WITH AUTOMATED IPAM**



Source: Enterprise Strategy Group, 2008

## The CIO To-Do List

ESG believes that a core network services solution based upon automated IPAM makes a lot of sense for reducing IT costs, modernizing the network infrastructure, and positioning the business for more effective network utilization. To move forward, CIOs should:

- **Assess current problems.** Gain an understanding about your current tools, processes, costs, and limitations. For example, how long does it really take the networking team to provision a new device? How often do configuration problems arise? Do these issues lead to business interruptions? Can the networking team track IP address usage over time? Answers to these questions will provide a baseline for comparing cost and operations impacts between existing solutions and a more modern alternative.
- **Look into pending IT and business initiatives.** Is the organization planning on SOA, server virtualization, or Web 2.0? Any plans for IP telephony or Unified Communications (UC)? These projects may already be baked into future business processes, making the need for automated core network services and IPAM integration more pressing. It may be possible to add network improvements into one of these projects. Near-term network improvements may also lower costs for future project teams that can then utilize automated IPAM rather than manual processes.
- **Do an ROI assessment.** With this data at hand, IT managers should do a cost/benefit analysis comparing simple tools and manual processes to a contemporary automated solution. Consider activities like time (and resources) spent: assigning, tracking, and reporting on IP address usage; dynamically linking device information to IP addresses; allocating and reclaiming IP addresses; correcting DNS configuration errors; etc. Make sure to estimate network and business interruptions based on current problems and the added complexity of future network changes.

By going through this analysis, it may be possible to easily justify a new core network services investment that includes automated IPAM. Even in tough economic times, IT cost savings and business benefits may make these improvements an easy sell to corporate executives, especially when the cost savings can be easily identified.

## The Bottom Line

In some cases, modern infrastructure—like power lines, roads/bridges, and water supplies—performs critical functions quietly in the background and is thus virtually ignored. The old adage, “if it ain’t broke, don’t fix it,” comes to mind here. What’s forgotten here is the value that this infrastructure plays. Yes, we take it for granted—until something goes wrong. Time and time again, we as a society have learned the hard way that our laissez faire attitude toward critical infrastructure can lead to serious problems and disastrous result like the disruption of transportation, communications outages, and even loss of lives.

The famous quote from George Santayana certainly applies with regard to core network services: “Those who cannot learn from the past are doomed to repeat it.” If core network services like DNS, DHCP, RADIUS, and IPAM continue to be based upon manual processes and generic technologies, we can only expect escalating costs, increased risk, and additional network downtime. This is not a recipe for a business-centric IT department or CIO career path.

The alternative to this apathy is action in the form of a resilient and automated core network services solution. Through the combination of automated IPAM, central management, and a grid architecture, investment here can deliver the scale, process automation, and manageability needed to enable next-generation network applications and business processes.



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