



Cost-Savings Analysis of IP Address Management Software: A Guide for Service Providers

An Incognito Software white paper
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Introduction

There has never been a greater need for service providers to adopt automated IP address management (IPAM). Worldwide, IP traffic and the number of internet-connected devices are growing at an exponential rate. Demand for high-speed data services and the growing adoption of Internet telephony, VoIP, and 4G mobile network deployments are responsible for the increase in traffic and are “exerting immense pressure on already creaking first-generation IPAM systems¹”. Research group Global Industry Analysts forecasts that, by 2018, the number of devices connected to IP networks will reach over three times the size of the global population and IP traffic will exceed 1.5 zettabytes per year. As a result, IP resources on the current Internet Protocol, IPv4, are running out. Since June 2011, device manufacturers and service providers in more than 100 countries have made the transition to the latest version of Internet Protocol, IPv6, for greater access to resources, better functionality, and improved network security. An IPAM solution is essential for the efficient allocation of remaining IPv4 addresses and to ensure a smooth transition to IPv6. An IPAM solution also enables providers to justify IPv4 requests to their regional Internet registry (RIR), assuming that it still has addresses available.

System integrators and analysts have recorded ROI of 150% to 500% over three years after companies move from manual to automated handling of IP and DNS.

However, IPv6 is not the only reason to consider an IPAM solution. With its automated workflow processes, identification of IP address space shortages, and tiered administration, IPAM is the primary driver in more than 60% of DNS, DHCP, and IPAM (DDI) projects². IP addresses provide network and device identifiers, and DNS records correlate IP addresses to domain names. If these numbers and names are inaccurate then users cannot access the network. Forrester Research found that most network downtime is due to manual errors in IP addresses and DNS records³. These errors affect every computer, modem, server, printer, VoIP phone, router, and other device that communicates over a network.

The same research also showed that analysts recorded a return on investment of 150% to 500% over three years after organizations moved from manual to automated IP address allocation and DHCP/DNS server configuration.

Even so, many organizations are still tracking IP address space manually, often in a spreadsheet. A study of 206 large organizations with over 5000 employees combined found that nearly 70% still used spreadsheets or another manual system⁴. The alternative – an IPAM solution – improves productivity, security, and reliability. Organizations looking for an IPAM solution benefit from a commercial IPAM software package as these are

¹ Global Industry Analysts Inc. “Internet Protocol Address Management (IPAM) - A Global Strategic Business Report,” 2012.

² Lawrence Orans, “MarketScope for DNS, DHCP and IP Address Management,” Gartner, 2012.

³ Thomas Mendel, “IP Address Management,” Forrester Research, Inc. 2004.

⁴ John Olsik, “The Economics of IPAM: Reducing Expenses and Boosting Availability with Automated Core Network Services,” ESG, 2009.

field-tested, engineered to meet reliability standards, and supported by specialist vendors.

An organization may delay the implementation of an IPAM solution if IT decision-makers do not have access to information about the business impact of manual errors or if they believe misperceptions that IPAM is difficult to deploy.

This paper discusses the critical factors involved in evaluating potential ROI for an IPAM solution, including automation-related savings and recovered revenues.

The Hidden Costs of Inadequate IP Management

The risks associated with inefficiently managed IP networks are clear: network access problems, security problems, dissatisfied customers, and lost revenue.

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As the number of devices connected to the Internet increases, IPv4 addresses becomes even scarcer, and network administrators spend more time than ever managing IP address space. More broadband operators are offering new IP-based services such as VoIP and IP video services, adding complexity to their networks and network administrators are responsible for managing thousands, even millions, of IP addresses. It is therefore no longer viable for service providers to manually track and monitor IP networks. Inaccurate IP management causes user access problems and creates extra work for IT administrators.

Every network device connected to the Internet or corporate intranet requires at least one IP address. Devices also need access to a DNS server to resolve domain names. If there is more than one device with the same IP address, a network router does not know where to pass data packets, and a service disruption results.

Ineffectively managed IP networks are the cause of the following problems:

- Service cancellations by existing customers (churn), a reduction in new customers, and excessive technical support time caused by the inability to provision the proper IP addresses.
- Delays in introducing new broadband services after being denied address space by an RIR due to inadequate utilization reports and growth plans, and an ineffective means of re-allocating existing IP addresses.
- Insufficient access for customers because of unavailability or duplication of IP addresses.
- Inability to diagnose a network outage or provide access privileges resulting from the lack of IPAM diagnostic tools.
- Delays in implementing business changes (for example, re-organizations) due to overlapping IP space.

Managing IP Addresses with an Integrated IPAM Solution

An end-to-end IPAM solution maintains an inventory of IP addresses in use, prevents deployment of duplicate addresses, and supports integration with DHCP and DNS servers.

When introducing an IPAM solution, an organization may provide a “management layer” over the top of existing DHCP and DNS servers, or install a completely new system that incorporates the management layer and more efficient DHCP and DNS servers. Both options offer substantial savings.

The management layer plays a supervisory role and is responsible for optimized allocation of IP address space. The management layer allocates IP address pools, analyzes address usage, forecasts address needs, verifies address availability, monitors security, and provides automated reporting.

The DHCP server answers requests for IP addresses from network devices and assigns each device an IP address from an address pool for a defined period of time (a “lease”). The IPAM solution ensures that the DHCP server allocates addresses from the correct pools.

If the device also needs to contact another network element using a domain name, a DNS server associates the domain name with an IP address and then transmits the address back to the device.

Migrating to IPv6

Worldwide, organizations are now preparing for the migration to a new version of Internet Protocol, IPv6. The Internet Engineering Task Force (IETF) designed IPv6 to cope with the shortage of IPv4 addresses and the global increase in IP-connected devices. IPv6 uses 128-bit addresses, allowing for a much higher variation of addresses than IPv4, which uses a 32-bit code. IPv6 provides more than 340 trillion, trillion, trillion addresses, compared to the 4 billion available on IPv4, and will help ensure the Internet can continue its current growth rate indefinitely.

Migrating to IPv6 requires service providers to invest in core IP infrastructure and end users to adopt compliant hardware. This investment is essential as IPv4 address exhaustion accelerates. Already, RIRs for Asia Pacific (APNIC) and Europe, Russia, the Middle East, and Central Asia (RIPE NCC) have run out of IPv4 addresses, while the North American RIR (ARIN) is projected to exhaust allocations by August 31, 2013.

The importance of an IPAM solution is clear as IPv4 resources dwindle and identifying new space becomes critical. An integrated IPAM solution simplifies the management of IPv4 and IPv6 addresses, including dual stack resource planning. It minimizes the impact that the shortage of IPv4 addresses has on a business by automatically managing and assigning IPv4 addresses in preparation for IPv6 implementation. Service providers that transition to IPv6 now can take advantage of increased demand for IP-based services and greater network security.

An IPAM solution reduces time and errors associated with setting up new users, managing service change requests, support, and RIR reporting.

Automation Savings Potential

An IPAM solution minimizes the time and errors associated with network planning and expansion, deploying new services, setting up new users, processing service change requests, troubleshooting network access and downtime, forecasting capacity requirements, and RIR reporting.

Manual methods of handling these activities are time-consuming and resource-intensive. Network administrators must manually edit server configuration files, check databases to verify IP address pools, and enter address assignments into spreadsheets or other files. Before assigning an address, they must assess each device's location, appropriate level of access, and suitable IP subnet. They then record the IP address in a database and update the DNS server configuration. A report from Enterprise Strategy Group (ESG)⁵ estimates that IT professionals using manual processes spend up to 80% of their operating budget simply maintaining existing infrastructure.

The right IPAM solution can reduce address management costs up to 80%

Such activities are invariably prone to human error, affecting employees and customers, and causing service disruptions. Assigning more staff to handle customer complaints or to oversee a specific region is not feasible in today's cost-conscious, competitive environment. Moreover, companies that use multiple spreadsheets (each of which may be managed differently) across various regions face significant network security concerns.

ESG research suggests that the right IPAM solution can reduce address management costs up to 80% by significantly reducing manual labor and policy enforcement, while also improving network availability.

In any savings calculation, providers need to consider business customers and residential customers differently. These groups generate different streams of income and require different types of support. Revenues lost per customer due to service delays or outages add up more quickly on the business side, especially when service level agreements (SLAs) are involved.

IP Address Allocation, Planning, and Optional DHCP/DNS Configuration for New Subscribers

In terms of adding new customers, the following factors determine the savings potential when moving from a manual system to an IPAM solution:

- The total number of subnets and IP addresses. If you are calculating the savings from a management-layer-only IPAM solution, then you can count IP address blocks for residential customers. If manual DHCP processes are involved, you need to include individual residential IP addresses.
- The number of new customers. This represents the number of new customers added based on their annual growth rates.

⁵ John Olsik, "The Economics of IPAM: Reducing Expenses and Boosting Availability with Automated Core Network Services," ESG, 2009.

- The average time for an IT department to:
 - Manually plan, allocate, track, and report on IP address blocks or subnets.
 - Manually set up an IP address for each user through DHCP and DNS.
- The average IT administrator and customer service representative salary included benefits (“loaded labor rate”).

Manual IP management can cost up to \$842,000 per year in an enterprise environment.

The cost of manual management adds up quickly. Industry research suggests that in an enterprise environment, manual IP management can cost up to \$842,000 per year⁶. The costs for service providers is even higher and includes additional expenses such as law enforcement compliance, RIR reporting, and customer support to fix errors and outages related to IP management.

The same research suggests that an enterprise can reduce this amount by at least \$239,000 annually with an IPAM solution that provides inventory assurance, IP address management, and IPv6 functionality. The savings potential is greater for service providers, as providers must undertake many more IP management tasks, as listed above.

Clearly, automating IP allocation tasks helps service providers increase efficiency and savings. In one recent case study⁷, a leading North American provider used spreadsheets to manage more than 1.2 million IP addresses. These spreadsheets contained over 200 tabs and thousands of records, and posed considerable managerial problems, including errors and a lack of accountability for modifications. This company switched to an integrated IPAM and DNS solution and reduced the time required to process an IP address order from 15 minutes to one minute.

One company switched to an IPAM solution and reduced the time required to process an IP address from 15 minutes to one minute.

This resulted in cost savings because administrators gained more time to complete other tasks. This solution also enabled greater visibility into DNS management.

Identifying Stale IP Addresses

In the past, service providers did not re-use static IP addresses, even if they were not in use. This was intended to ensure that no two customers or devices ever used the same static address. However, with the depletion of IPv4 addresses, this practice is no longer acceptable. More than ever, operators need to clearly understand how IP addresses are configured on a network, which addresses are in use, and which are considered “stale”. This requires information from:

- DHCP servers, to identify which IPs are dynamic and therefore excluded from the “stale” static IP search
- Spreadsheets or tools, to sort which IP addresses are used for the provider’s different services

⁶ Timothy Rooney, *Introduction to IP Address Management: IEE Press Series on Network Management*, (New Jersey: John Wiley & Sons, 2010).

⁷ Incognito Software. “How One Company addressed its Resource Management Inefficiencies using an Integrated IP and DNS Management Solution,” 2012.

- Network element systems, to track down records about the static IP addresses that have been configured
- DNS, to provide details about the addresses and hostnames

An IPAM solution eliminates the cumbersome and time-consuming tasks listed above by enabling a provider to collect information about stale IP addresses automatically, either in real time or using background processes. With this information, an operator can return nodes to a free pool or decide whether or not to renumber a subnet, all in a matter of clicks.

Reconfiguring IP Address Space and DNS for Service Changes

To calculate the possible savings for moving from manual to automated re-configurations that are the result of service changes, use the average number of business subnets requesting service changes each year, combined with an average time per change and the average IT administrator's salary. A business-related manual re-configuration typically takes about 30 minutes.

For one service provider, the percentage of business subnets requiring service changes each year averaged 5%, at 30 minutes per re-configuration. That represents over 25 hours per month and about \$12,000 per year.

Managing Host Names in IPAM and DNS

Managing DNS host names manually in an address management system and DNS causes inefficiencies and creates additional work, as operators will need to identify and resolve inconsistencies that arise in the future. Proper DNS configuration enables services such as email to operate correctly and allows administrators to perform troubleshooting.

Inaccurate records can cause customer problems and require support staff to resolve. In an IPAM solution, an IP address with a hostname references an address record in DNS. That address record also has a corresponding pointer (PTR) record. The solution should also be flexible enough to deal with the various DNS scenarios that exist in a service provider's environment. It should automatically synchronize the DNS based on hostnames entered into the IPAM system, and support two-way synchronization to eliminate duplication of work and reduce the risk of manual errors.

Manage IP and DNS Assignments for Business Customers and Internal Business Units

Business customers often request services that require IP ranges, DNS host-names, and device information. This information may be stored in different systems that are managed by different operational units. As a result, processes such as service activation or troubleshooting become complicated and require the involvement of specialized staff.

An IPAM solution simplifies this process and presents a customer-centric view of provisioning systems and customer service providers. Providers can take this one step further by creating user portals to allow customers to handle common tasks themselves,

The percentage of business subnets requiring annual service changes averaged 5% for one service provider, and cost \$12,000 per year.

An IPAM solution allows an operator to quickly identify network configuration problems before the services are activated.

further reducing the need for support staff involvement. This allows providers to reduce operational costs while providing an efficient subscriber service.

Correlate Network Configuration with an IP Plan

In a traditional workflow, the team responsible for renumbering networks or adding new routing elements is often separate from the one that is responsible for IP planning. When those making the network changes do not have a simple way to automate requests for IP addresses, the process can become a bottleneck.

In some cases, the process may lead to mistakes that are difficult to identify and can cause a customer outage. With an IPAM solution, the process of configuring and reconciling differences between what was planned and what is configured on the network is simplified, allowing an operator to quickly identify problems before the services are activated. An IPAM solution allows for simplified network configuration, improved workflow, and fast diagnosis of customer problems.

Reductions in Troubleshooting Access and Downtime Issues

The percentage of addresses or business subnets experiencing troubleshooting issues can easily reach 10%⁸ using manual IP address administration. These issues stem from errors in server configuration files, inconsistent or invalid naming due to decentralized management, and, frequently, data entry errors. These, in turn, lead to problems with security, domain resolution, and invalid IP addresses.

The corresponding network downtime and service outages result in customer service calls and technical support time, with manual troubleshooting averaging 45 minutes per issue.

Time Savings in Analysis and Forecasting of Address Capacity

An IPAM solution simplifies reporting, data collection, data analysis, and the re-allocation of IP addresses to where they can most effectively meet shifting needs.

With manual allocation, a service provider cannot use its IP resources in an optimal manner. For example, if a provider has limited IP space in one region but an abundant supply in another region, they face the nearly impossible task of moving IP addresses to where they are needed most.

The manual “grooming” of blocks of IP address space to meet varied levels of demand (by customer type, region, or service) is a time-consuming process. It involves manual reviews of server logs for changes in usage and capacity. As well, IT administrators in one region do not know when previously allocated addresses are unused in another region unless they search for them. Those unused addresses are valuable, as they save the service provider from having to purchase more from an RIR.

The manual “grooming” of blocks of IP address space to meet varied levels of demand is a time-consuming process.

⁸ Stan Schatt, “The Savings from Automated IPAM Software,” Giga Information Group, 1999.

Industry case studies have shown an average of four hours per month is required for every 10,000 business subnets or every 10,000 residential IP addresses.

IPAM solutions also enable providers to avoid the cost of not adding unnecessary IP address space. This is due to improved viewing, monitoring, and reporting capabilities.

Savings in RIR Reporting

Finally, service providers must consider the cost for administrators to compile and analyze multiple reports to satisfy the requirements of RIRs and, in the case of ARIN reporting, to provide Shared Whois Project (SWIP) updates for the WHOIS database. RIR reports are needed periodically and whenever the provider wants to request more address space.

RIR reporting typically consumes at least one month of each administrator's time. This time includes both validating current use and requesting additional IP addresses as the customer base grows and new services are introduced. New services frequently require more than a single IP address per customer. With fewer available IPv4 addresses, providers now receive fewer address block allocations, and go through the request process more frequently, tying up valuable resources that could be directed elsewhere.

Service providers can estimate the cost of manual RIR and SWIP reporting by considering the number of times per year they need to expand IP address space. For example, at a 20% growth rate, assuming that the provider is already using over 80% of address space, RIR reports (at eight hours per 1000 subnets or residential addresses) and requests could happen two or three times per year – and that number is increasing. As IPv4 space becomes less available RIRs are giving out smaller allocations, requiring service providers to go through the request process more frequently.

RIRs also require a SWIP update for every subnet that is assigned. The times for manual SWIP reporting depend on the customer growth rate, at approximately 10 minutes per SWIP email message.

Annual Recovered Revenues Potential

Manual IP management causes a significant impact to the bottom line, and lost revenue opportunities may prove even more costly than staff labor.

Some service outages are caused by IP address-related problems. When customers do not receive service with a high level of reliability, they quickly find a competitor that satisfies their needs. Also, providers that cannot add new customers because of the lack of address space risk missing out completely because these users simply turn to another provider that supports growth.

According to industry research on churn and customer satisfaction⁹, a churn rate of less than 4% is acceptable. In one

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Lost revenue opportunities may prove even more costly than staff labor.

⁹ Alex Goldman, "Market Research: Notes to Top ISPs by Subscriber, Q4 2002," ISP-Planet, 2003.

example, a service provider managing one million IP addresses lost 150 existing customers each year due to IP-related problems.

Recovered Customer Revenues

IP-related service outages may cause service providers to lose 1% of the 5% of customers affected, and in a highly competitive environment, this figure can be much higher. The recovered revenue calculation is based on the revenues a service provider would have made if those customers had not left.

At the same time, industry research suggests that an IPAM solution can eliminate 90% of IPAM-related network downtime and actually improve user productivity¹⁰.

Reduced Service Delays or Interruptions

Delays in subscriber activations mean that services cannot be billed immediately. An IPAM solution can reduce activation time by a minimum of one day, according to a conservative estimate. This translates into at least one extra day's worth of revenue per subscriber.

Maintaining Service Level Agreements

Service level agreements (SLA) provide guarantees to business customers for service reliability. If service disruptions go beyond the thresholds stipulated in an SLA, the provider must pay the customer a penalty. A small breach of an SLA can incur a penalty up to 33% of the monthly fee while a large breach of SLA can result in a penalty between 50% and 100%¹¹. Even if only 10% of disruptions affect SLAs, the penalties can quickly add up. An IPAM solution reduces the chance of service disruptions and, therefore, SLA breaches.

The need for effective management of IP address space has become critical to an organization's profitability.

Summary

As IP-based networks grow in size and complexity, the need for effective management of IP address space has become critical to an organization's profitability. There are also tighter restrictions on new allocations of IP address space from RIRs.

Inadequate address management has a direct impact on the bottom line. It leads to lost revenues, increased costs, inefficient staffing, and less time on business-critical activities.

An integrated IPAM solution provides excellent opportunities to recover revenues, reduce costs, re-position staff, and maintain uptime.

IPAM solutions allow for network discovery by enabling the tracking of new network devices, securing the DNS server, identifying rogue devices on the network, tracing movements of end devices through switch/port connection history, and identifying IP addresses associated with security breaches. All of these advantages help

¹⁰ John Oltsik, "The Economics of IPAM: Reducing Expenses and Boosting Availability with Automated Core Network Services," ESG, 2009.

¹¹ Bozidar Spiroski, "Telco SLA Parameters and Penalties," Infosec Island, 2010.

accelerate security investigations and result in increased productivity and lower operating costs.

About Incognito Software

Established in 1992, Incognito Software is an industry leader in IPv6 and a global provider of broadband device provisioning, network intelligence, resource management, and service activation solutions.

To learn more about how an IPAM solution can help your business increase efficiency and save resources, download a case study at http://www.incognito.com/resources/ac/cs_anc.pdf.

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