IP Address *Nirvana*

by Barry Nance

Of the three products we tested, Lucent Technologies' VitalQIP™ DNS/DHCP and IP Address Management software led the pack with outstanding performance, scale, reliability and broad platform support.

Some problems should never, ever show up on your company's morning IT problem report. When the CIO – your Chief Information Officer – finds user client computer outages resulting from duplicate IP address errors in the morning problem report, it's a needless and eminently avoidable waste of both time and money on everyone's part, from the hapless user to the overworked network administrator to the frustrated CIO.

Moreover, any effort your company expends on managing IP addresses beyond just specifying policies and rules is a similar waste of company money.

The most important criteria for a DNS/DHCP tool is performance.

Fortunately, IP address management and assignment chores are easily automated. The RFCs for the Domain Name System (DNS) and the Dynamic Host Configuration Protocol (DHCP), when embodied in a well-designed IP address management software tool, provide exactly the right foundation for making IP address maintenance chores a thing of the past.

Tools that automatically manage and assign IP addresses and which offer easy administration of TCP/IP protocol stack configurations are readily available, mature and, at a typical cost of less than $5 per node, not all that expensive. But which IP address management tool is best for your company?

To determine the best IP address management tool, we tested three products from vendors claiming to offer enterprise-ready IP address automation. Our review put Lucent Technologies' VitalQIP™ 6.0, Check Point's Meta IP™ NG and Cisco's Network Registrar 5.5 through their paces. See "Network Testing Labs' Testbed and Methodology" for a description of the tests.

Lucent's VitalQIP™ emerged the clear winner of our evaluation, excelling in performance, platform support, scalability and reliability. It can eliminate duplicate IP address and other IP address problems on even the largest network. VitalQIP™ earns Network Testing Labs' World Class award for best IP Management and DNS/DHCP tool.

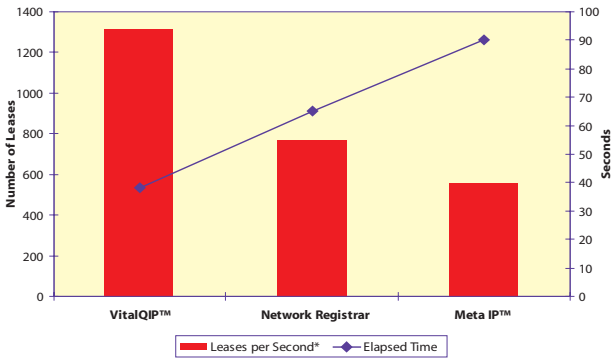
We found VitalQIP™ to be much more than just an IP address dispenser. It outshined the other products at managing DNS domains and servers, IP networks and subnets, and DHCP scopes and servers. Through its holistic view of our network, VitalQIP™ let us view our IP devices by network, subnet, domain, DNS server, DHCP server, and by a user defined hierarchy.

Performance

The most important criteria for a DNS/DHCP tool is performance. The tool should use network resources frugally yet dole out dynamic IP addresses responsively and unobtrusively.

We measured the performance of these three DNS/DHCP tools by running client software that rapidly requested a total of 50,000 dynamic IP addresses and noting the time each DNS/DHCP tool took to respond to those DHCP requests. We ran six instances of the test program, one on each network segment in the lab. Figure 1 reveals the DHCP benchmark results.

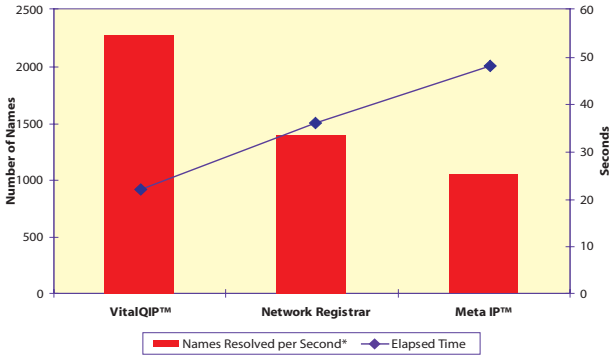
Figure 1. DHCP benchmark results.



**50,000 divided by the elapsed seconds value*

We also benchmarked DNS activity. Our test client software issued a flood of 50,000 name-to-IP address resolution requests and obtained responses from a DNS server. Figure 2 reveals these DNS benchmark results.

Figure 2. DNS benchmark results.



**50,000 divided by the elapsed seconds value*

You can see from the results in both Figures 1 and 2 that VitalQIP™ is by far the fastest tool. VitalQIP™ has the capacity and speed to handle millions of IP addresses with ease. Network Registrar and Meta IP™ lagged far behind VitalQIP™, suggesting that Network

Registrar and Meta IP™ are more resource-intensive than VitalQIP™. We found this to be true in our tests. In the benchmark tests, the two slower tools used both more network bandwidth and more server computing resources than VitalQIP™. These results indicate Network Registrar and Meta IP™ aren't as enterprise-ready as their vendors claim. As we explored the reasons for its quicker performance, VitalQIP™'s multithreaded design revealed itself when we investigated its fast performance via Windows 2000 Advanced Server's Performance Monitor. Network Registrar's design is multithreaded, but not to VitalQIP™'s degree.

VitalQIP™ showed an ability to handle large volumes of IP addresses and assign them rapidly. To our delight, when we simulated server CPU resource contention by running several other software products on the DNS/DHCP servers, VitalQIP™ let us easily spread the IP addressing workload across multiple servers. Network Registrar and Meta IP™ do not have a tier-based distributed architecture.

Scalability and Reliability

Scalability is important for a DNS/DHCP tool. For a relatively small network, the tool should have an architecture that allows you to run it alongside other software on a single server. For an enterprise-size network, the tool's architecture should allow you to spread its workload across multiple servers as necessary.

Because new clients joining the network from moment to moment need faithful, always-available IP address assignment services, reliability is also a key criterion for a DNS/DHCP tool.

Our tests showed VitalQIP™ exhibits better scalability and reliability than either Network Registrar or Meta IP™. VitalQIP™ has a well-designed distributed architecture that customers can easily configure to run in a wide variety of computing environments. VitalQIP™'s distributed architecture makes setting up a robust, 24 x 7 DNS/DHCP service a completely painless process. We easily set up VitalQIP™ to run on one server or a cluster of servers in the lab.

Network Registrar and Meta IP™, practically speaking, are only scalable to the extent you can run each product on a faster or slower server computer.

Scalability is important for a DNS/DHCP tool.

In our reliability tests, the VitalQIP™ DHCP server failed over as necessary on a many-to-one basis to ensure IP address leases weren't orphaned or reassigned. For the sake of continued operation if a hardware failure were to occur, it sent dynamic updates to primary or secondary DNS servers and recorded the address

Executive Summary

The rapid expansion in data traffic and user expectations for emerging IP services continues to place increasing strain on network managers who need to control the assignment of IP addresses. Network managers need to manage a diversity of services ranging from basic data networking, Internet access, voice over IP (VoIP or IP telephony), virtual private networks (VPNs), wireless data access via wireless LAN or third generation ("3G") cellular systems, instant messaging, email, and many more services. Fortunately, IP address management and assignment chores are easily automated. Our review of tools from Lucent Technologies, Check Point Software and Cisco focuses on the software's usefulness in managing DNS domains and servers, IP networks and subnets, and DHCP scopes and servers. We considered their performance, scalability and reliability, platform support and interoperability, IP management, and ease of use.

We awarded Lucent Technologies' VitalQIP™ DNS/DHCP and IP Address Management software our World Class award for it's outstanding benchmark results, scale, reliability and broad platform support.

assignments in its Sybase or Oracle central relational database. VitalQIP™ stores the entire IP network inventory – IP networks, subnets, addresses, DNS/DHCP servers, scopes and domains in its RDBMS. This architectural approach, we feel, not only buttresses VitalQIP™'s reliability but also distinguishes VitalQIP™ as a complete IP management system.

Network Registrar's redundancy feature uses a backup server to automatically take over if the primary server is inaccessible. Via multiple LDAP (Lightweight Directory Access Protocol) data stores that you configure to replicate among themselves, Meta IP™ can provide multiple levels of failover to ensure the availability of its IP addressing services. Meta IP™ offers one-to-one replicated failover as well as many-to-one DHCP service failover. Like VitalQIP™, Meta IP™ and Network Registrar incorporate software-based failover mechanisms for redundancy.

Platform Neutrality and Interoperability

Unix shops shouldn't need to install a Windows-based server just for IP address assignment chores, and Windows shops shouldn't need to install a Unix-based server just for DNS/DHCP. A DNS/DHCP tool should be one of the most platform-neutral programs you run in your network operations center.

Similarly, the DNS/DHCP tool should interoperate transparently with other DNS/DHCP-aware software on the network. Furthermore, how an IP address management product stores address pool data and user classification data is a key factor for how well the product performs, how well it reports its activities and how easily customers can tailor the product to their specific computing environments.

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The VitalQIP™ components run ubiquitously on Windows servers as well as Solaris, AIX and HP-UX servers. The DNS/DHCP server component additionally runs on Linux, but the centralized Enterprise Server component isn't yet ported to Linux.

Similarly, Network Registrar runs on Windows, Solaris, HP-UX and AIX. Network Registrar's graphical user interface (GUI) isn't available, however, on HP-UX and AIX. Meta IP™'s Management Server runs on Linux, Windows and Solaris, and its Management Console runs just on Windows.

A big plus for VitalQIP™ is its included Sybase Adaptive Server relational database, which makes VitalQIP™ a self-contained DNS/DHCP tool. VitalQIP™ works equally well with the included Sybase RDBMS or an Oracle RDBMS that you supply, if you're an Oracle shop.

We used both the Sybase RDBMS and Oracle RDBMS in the lab, and we found the Sybase RDBMS to be slightly faster. VitalQIP™ offers a great number of report formats, and the ability to query its relational database with ad hoc reporting tools is icing on the cake.

Sybase Adaptive Server is a high-end relational database customers can easily access with Crystal Reports or other SQL-based query tool. We noted another nice touch in VitalQIP™ – Lucent publishes the database schema for customers to use.

All three products support the Internet Software Consortium's (ISC's) Berkeley Internet Name Domain

Report Card

What's the Grade?	VitalQIP™	Network Registrar	Meta IP™
Performance	A	B	C
Scalability and Reliability	A+	B	C
Platform Support and Interoperability	A	B	B
IP Management	A	B	C
Ease of Use	B	B	A
Documentation and Installation	A	A	A
Average Score	A	B	B-



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Organizing your Network

Whether it's a Classless InterDomain Routing (CIDR) address or traditional class A, B or C address, an IP address should have some relevance to the computer or network device it's assigned to. A DHCP server that assigns addresses on a completely random basis is of little help to busy network administrators who work hard to impose some organization on networks that tend over time toward chaos.

Fortunately, these DHCP/DNS products offered a variety of ways to associate an IP address with specific users, devices and subnets.

VitalQIP™'s Registration Manager option lets it distinguish requests for IP addresses by MAC address as well as DHCP Vendor Class and User Class. It also offers DHCP policy templates for assigning IP addresses by location, network adapter manufacturer, operating system, wiring hub group or other criteria. VitalQIP™ even provides for the assignment of "short lease time" IP addresses to mobile users, if you so choose. A network administrator can also tell VitalQIP™ to allocate an address based on group membership in an alternate or preferred subnet. VitalQIP™ clients can belong to a single group or multiple groups.

The Subnet Organizer component within VitalQIP™ handles true Variable-Length Subnet Masking (VLSM), which we used to easily join subnets with other non-contiguous subnets as well as split them.
It also provides a customizable management interface for delegating an IP address space to specific administrators or groups of administrators across domains, networks, and subnets. VitalQIP™ transparently and quickly passed the appropriate DHCP and DNS inheritances to the newly configured subnets that we created.

Meta IP™'s User-to-Address Mapping technology detects logons and equates logon account IDs with assigned IP addresses. Using Meta IP™, we mapped dynamically-assigned IP addresses to clients based on file server logon account ID, logon time and MAC address. By automatically correlating logons with dynamic IP address leases, Meta IP™ let us painlessly track address assignments by user rather than by machine address. With Network Registrar's DHCP, we were able to assign IP addresses based on Media Access Control (MAC) address, device type, user class, vendor class, and other defined criteria.

(BIND) versions 4.9 and 8, with extensions. The three DHCP servers functioned perfectly, as either primary or secondary, when run alongside the other products' DHCP servers.

VitalQIP™, Network Registrar and Meta IP™ all sport thoughtful, intuitive GUIs…

Worth mentioning is VitalQIP™'s unique and yet highly interoperable approach to incremental zone transfers (IXFRs). Instead of embracing the cumbersome and unreliable RFC 1995 process, Lucent's programmers designed a BIND extension that uses Dynamic DNS to accomplish the transfer and keep master and slave servers synchronized. As a further backup mechanism, VitalQIP™ periodically performs full zone transfers (AXFRs). Its unique implementation lets VitalQIP™ update both primary and secondary servers using Dynamic DNS and, at the same time, fully support both the IXFR and the AXFR mechanisms.

Network Registrar and Meta IP™ use LDAP to store IP address information, and Network Registrar has an SQL-based option for exporting IP address specifications to a relational database that you supply. The vendor-provided Network Registrar and Meta IP™ reporting tools, barely adequate for small- to medium-sized companies, are wholly unsuited for enterprise use.

All three products integrated in our tests with Windows 2000's Active Directory-based DNS and DHCP facilities. However, we noted that VitalQIP™ is the only tool that performs External Dynamic Updates (EDUPs), which eliminate the need to execute a manual CLI in the Windows 2000 environment. Moreover, VitalQIP™'s immediate propagation of dynamic updates means DNS servers can run in a multi-master configuration. VitalQIP™'s management of Windows 2000 DNS and DHCP servers includes Active Directory authorizations, support for multicast address allocation, the proper emitting of DNS Server Resource Records (SRV) according to the DNS dynamic update protocol (RFC 2136), flexible dynamic DNS updates, secure DNS support and multi-master DNS support. In contrast, Network Registrar meets Microsoft's minimum requirements for SRV records and RFC 2136. Meta IP™ keeps DNS information accurate by supporting RFC 2136-compliant dynamic DNS as well as the SRV records required by Active Directory.

Ease of Use

Once you establish your IP addressing rules and policies, a good DNS/DHCP tool should be neither seen nor heard. The smooth operation of your network's IP address assignment mechanism means you shouldn't have to spend a lot of time dealing with or even thinking about it. Nonetheless, occasional tasks such as moving a group of client computers from one subnet to another or adding a new group of client computers shouldn't require enormous expenditures of time and effort.

VitalQIP™, Network Registrar and Meta IP™ all sport thoughtful, intuitive GUIs that their respective programmers and designers obviously spent a great deal of time on. As mentioned earlier, however, Network Registrar's GUI isn't available on the HP-UX and AIX platforms.

The VitalQIP™ interface, either Motif or Windows, displays an expandable tree view of the network's IP address space, with top level categories for domains, networks, OSPF areas, subnets and subnet organizations. The interface offers a user-defined hierarchical view, and expert users will appreciate its plethora of toolbar icons for accomplishing just about any task the user wants. VitalQIP™'s templates also help make quick work of setting up or modifying DNS or DHCP policies and configurations.

Meta IP™ used to have an easy-to-navigate administration interface contained completely within the Microsoft Internet Explorer browser as a Java applet. Sadly, Check Point no longer supports the Java interface, opting instead for a Microsoft-centric Windows interface. The Windows interface is richer and more responsive than was the Web-based browser interface, but we feel Check Point may have taken a wrong fork in the road by limiting Meta IP™'s user interface to just Windows.

Network Testing Labs' Testbed and Methodology

Our test environment for this review consisted of multiple routed Fast Ethernet subnet domains and a T1 ISP connection. The Internet link let us perform massive zone transfers and other large-scale IP address operations, but most of our testing occurred just on our network's intranet. Throughout the subnet domains, we ran several concurrent instances of a computer program that issued DHCP-DISCOVER messages. Some of these messages were valid requests for IP address information, but we also deliberately created many invalid requests. Our invalid situations included duplicate requests, missing DHCP-REQUEST messages and lease renewal requests at other than the usual lease half-life interval. To cause address reassignment activity, we forced clients to frequently join and leave the network. In a performance test, we measured how quickly each DHCP server could assign 50,000 IP addresses.

Because multiple subnets often coreside on a single broadcast segment during a migration to a flat switched network topology, which can result in the use of a wrong subnet during address assignment, we tested the products' handling of implied source subnet qualifier overrides to verify selection of the correct address for a particular logical network. We moved clients from one subnet to another, gave unique values to the DHCP client ID field and assigned different values to the user class ID and vendor class ID DHCP parameters to see how the DHCP servers would respond. We looked at how each vendor's DHCP server handled sequences of both valid and invalid DHCP-DISCOVER, DHCP-OFFER, DHCP-REQUEST and DHCP-ACK messages. We tested each DHCP server's ability to respond to a variety of different platform's TCP/IP protocol stacks with DHCP configuration options appropriate to those platforms. We also evaluated each product's dynamic DNS functions as well as its ability to efficiently update its DNS database with names and addresses from an Internet DNS server.

We factored in the ease with which we could administer the products, either centrally or remotely, paying particular attention to each vendor's address pool maintenance and network monitoring tools. We looked at each product's support for BIND 8 and DHCP, determined each product's level of security and judged each product's scalability, fault tolerance and architecture.

We ran the IP address management tools on six H-P/Compaq ML570 Proliant computers, each with 4 900-Mhz Pentium processors, 2GB bytes of RAM and eight 9G bytes SCSI RAID drives. In each case, the operating system platform was Windows 2000 Advanced Server. The client computers on the lab's network were a mix of Windows 2000 Professional, NT Workstation 4.0, Windows 98, and Macintosh System 8 platforms. An Agilent Advisor protocol analyzer eavesdropped on the network traffic to reveal both overall utilization and the content detail of the DNS/DHCP traffic.

The Network Registrar GUI is deceptively simple. Its ease of navigation is a result of its simplicity because the tool's interface limits the actions you can take. To its credit, Network Registrar's attention to design detail is apparent in such features as its context-sensitive pop-up menus. Our tests revealed that, unfortunately, Network Registrar supports only one administrator logged into a DNS/DHCP server cluster at a time. VitalQIP™ and Network Registrar have Unix (Motif) and Windows GUIs for managing servers locally or remotely. VitalQIP™ additionally comes with a Web server (Apache) and browser-based interface.

We especially liked VitalQIP™'s network-wide visibility, which meant we didn't need to keep track of which DNS/DHCP server is controlling a particular scope or domain. VitalQIP™ and Meta IP™ both have a handy delegation feature that a network administrator can use to securely assign IP addressing responsibilities to assistants located throughout an enterprise.

All the products' interfaces, whether Web- or Windows-based, showed DNS and DHCP servers, zones, subnets, current leases and IP address subpools.

All three products were easy to install and came with clear, comprehensive printed documentation.

Conclusion

Lucent Technologies' VitalQIP™ emerged the clear winner in our tests. It's a self-contained, world-class IP address management tool no enterprise network or service provider should be without.

About Network Testing Labs

Network Testing Labs performs independent technology research and product evaluations. Its network laboratory connects myriads of types of computers and virtually every kind of network device in an ever-changing variety of ways. Its authors are networking experts who write clearly and plainly about complex technologies and products.

Network Testing Labs' experts have written hardware and software product reviews, state-of-the-art analyses, feature articles, in-depth technology workshops, cover stories, buyer's guides and in-depth technology outlooks. Our experts have spoken on a number of topics at PC Expo and other venues. In addition, they've created industry standard network benchmark software, database benchmark software and network diagnostic utilities.

About the Author

Barry Nance is a networking expert, magazine columnist, book author and application architect. He has 29 years experience with IT technologies, methodologies and products. Over the past dozen years, working on behalf of Network Testing Labs, he has evaluated thousands of hardware and software products for ComputerWorld, BYTE Magazine, Government Computer News, PC Magazine, Network Computing, Network World and many other publications. He's authored thousands of magazine articles and three popular books, ***Introduction to Networking (4th Edition), Network Programming in C and Client/Server LAN Programming****.*

He's also designed successful e-commerce Web-based applications, created database and network benchmark tools, written a variety of network diagnostic software utilities and developed a number of special-purpose networking protocols. You can e-mail him at ***barryn@erols.com****.*