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An Infrastructure Can Only Be As Efficient As DNS, DHCP, And IP Address Management

by Andre Kindness

for Infrastructure & Operations Professionals



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I&O Should Focus Its Energies On DDI Operations, Not Development

by **Andre Kindness**

with Robert Whiteley and Jessica McKee

EXECUTIVE SUMMARY

When was the last time you heard of a company building its own personal computers for its employees? Cobbling together hard drives, CPUs, memory, and operating systems is not cost-effective or a core competency for any I&O teams. And yet there are lots of enterprises that continue to build out their homegrown DNS, DHCP, and IPAM (DDI) solutions. Most are woefully outdated, stagnating on non-enterprise-grade infrastructure, and lacking security mechanisms. To prevent your network from becoming a hurdle to supplying a flexible and efficient set of infrastructure services, you must bolster the “dial tone” of your network, where devices and services plug in and connect to other apps and infrastructure. How? First, recognize that DDI is a fundamental component to automating your infrastructure. Next, transition your services off commodity hardware to newer appliances. And finally, invest in the commercial solutions that pre-integrate DDI. This document will elaborate on how to do that and highlight solutions from Alcatel-Lucent, BlueCat Networks, BT Diamond, and Infoblox.

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Forrester interviewed vendor and user companies, including 6Connect, BlueCat Networks, BT Diamond IP, and Infoblox.com.

Related Research Documents

[“Empower I&O Staff With Automation”](#)
October 22, 2010

[“Managing The IT Management Software Portfolio”](#)
September 25, 2008

ALIGN YOUR FUNDAMENTAL NETWORKING COMPONENTS WITH BUSINESS STRATEGY

Businesses are forcing infrastructure and operations (I&O) professionals to create a self-service infrastructure — one that orchestrates services on the fly. Why? Because today's employees are dispersed, highly mobile, empowered, and embedded in their customers' lives.¹ As a result, infrastructure must recognize the users' needs and weave a set of services on the fly to meet the users' expected experience. Forrester calls a network architected to this specification a user experience network (uXn).² To align your network with these business needs, I&O teams must eliminate waste: latency, repetitious activities supported by personnel, and one-offs. I&O can expect:

- Best-in-class tools snapping into larger orchestration management software (see Figure 1).³
- IT automation coupled with component standardization.
- A new wave of converged and integrated solutions.
- A workforce evolving from craftsmen to architects and engineers.

I&O should follow lessons learned from other business environments — such as manufacturing and retail — and leverage a combination of people, automation, and abstracted pools of resources. In essence, I&O must industrialize its processes to achieve more efficient business outcomes and sustainable competitive advantage.⁴ The industrialization efforts enable the consolidation of processes to effectively eliminate death by a thousand cuts. It provides a simplified workflow, deployment, configuration, and maintenance of infrastructure that organizations are striving to achieve.

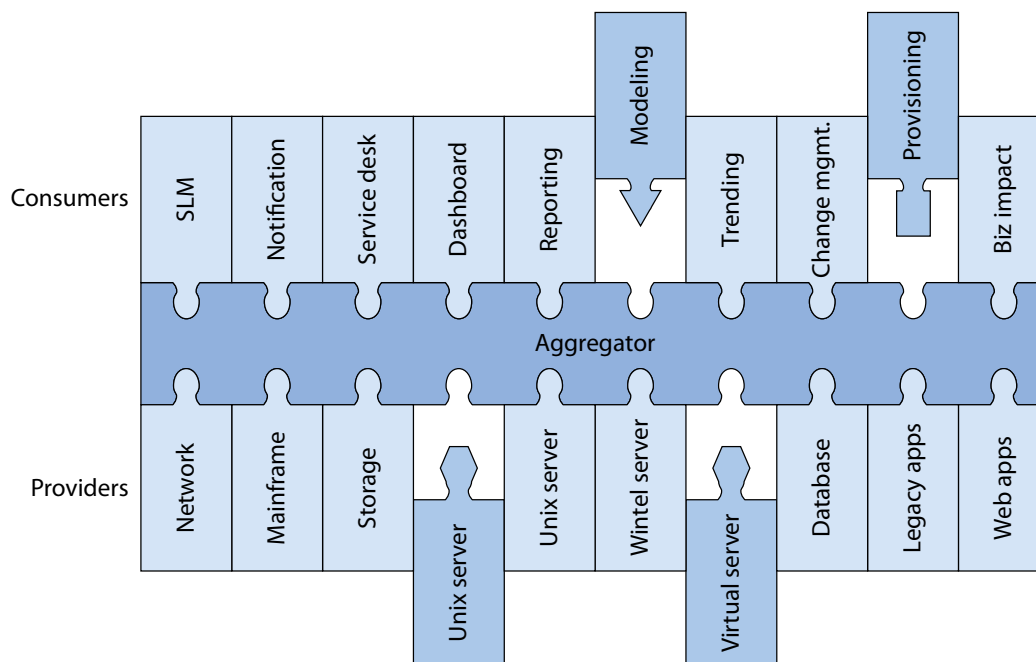
Five Changes Occurring In Infrastructure Will Force A DDI Refresh

A key building block of IT is the dial tone of the IP network; it's an always-on, always-available service for connecting to data and applications, but it's rarely discussed, almost forgotten. Most companies don't invest in the infrastructure that's needed to support it. As a result, this dial tone is woefully out of date, stagnating on non-enterprise-grade infrastructure, lacking security mechanisms, and highly manual. This dial tone consists of three components:

- Dynamic host configuration protocol (DHCP).
- Domain name service (DNS).
- IP address management (IPAM).

Most I&O organizations have put little effort into creating a highly resilient, scalable, and automated system that clicks into the rest of orchestration architecture. Enterprises have mainly invested in a basic DDI solution such as Microsoft's DHCP or have relied on in-house-developed solutions with open source code. However, basic DDI functionality — fault, configuration, accounting, performance, and security — does not meet the demands of today's businesses.

Figure 1 I&O Must Develop Network Capabilities Using A Modular Tool Architecture



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Source: Forrester Research, Inc.

Allocating new IP addresses is predominantly manual, whether they're for deployment of new applications, introducing smartphones, or enabling manufacturing machinery to communicate across Ethernet. But matters are going to get worse. Operational costs will exponentially increase when DDI faces new forcing functions. I&O will need to refresh DDI deployments as a result of five trends:

- **New devices will cause an explosion in IP addresses.** The number of IP addresses will skyrocket from the average four per employee to hundreds with the explosion of mobile devices and non-IT devices — HVAC sensors, flow controls, vending machines, etc. — connecting to the infrastructure.⁵
- **Centralized and virtualized data centers will deliver global applications.** The trend toward global application delivery out of centralized data centers will fuel additional demand on the network as workloads are moved on the fly to maximize hardware utilization. Virtualization is allowing applications to become fragmented and dispersed, which further increases the number of addresses under management.
- **Managing dynamic corporate environments will become more complex.** End-to-end service levels can only be ensured if all of the components involved can be monitored and controlled.

Companies have to eliminate all possible causes of human error. All this must be done in light of the growing importance of service-level management, the rise of networked applications, and the decreasing tolerance of users if those applications are not working.

- **The exhaustion of IPv4 addresses will force a transformation to IPv6 systems.** The world is running out of IPv4 addresses. The Internet Assigned Numbers Authority gave out the last IP addresses to the five regions, the Asia Pacific Network Information Center gave out the last of its addresses, and subsequent regions will follow. Global companies will need to evolve to IPv6 infrastructure to connect to new customers, vendors, resources, and partners.
- **Security exploits will force the need for enhanced DNS security (DNSSEC).** DNSSEC adds digital signatures to normal DNS queries, substantially reducing the risk of falling victim to man-in-the-middle attacks such as the Kaminsky exploit, which caused widespread panic in July 2008.⁶

FIVE REASONS I&O SHOULD BUY A COMMERCIAL DDI SOLUTION

Strong management software is needed as a means to not only manage the IP addresses but to adequately service the heavy load of requests to map addresses to devices and human-readable domain names. But the DDI market didn't start as a single solution; rather, it evolved from spreadsheets to either: 1) commercial all-in-one solutions, or 2) home-grown solutions that cobble together free or open source products.

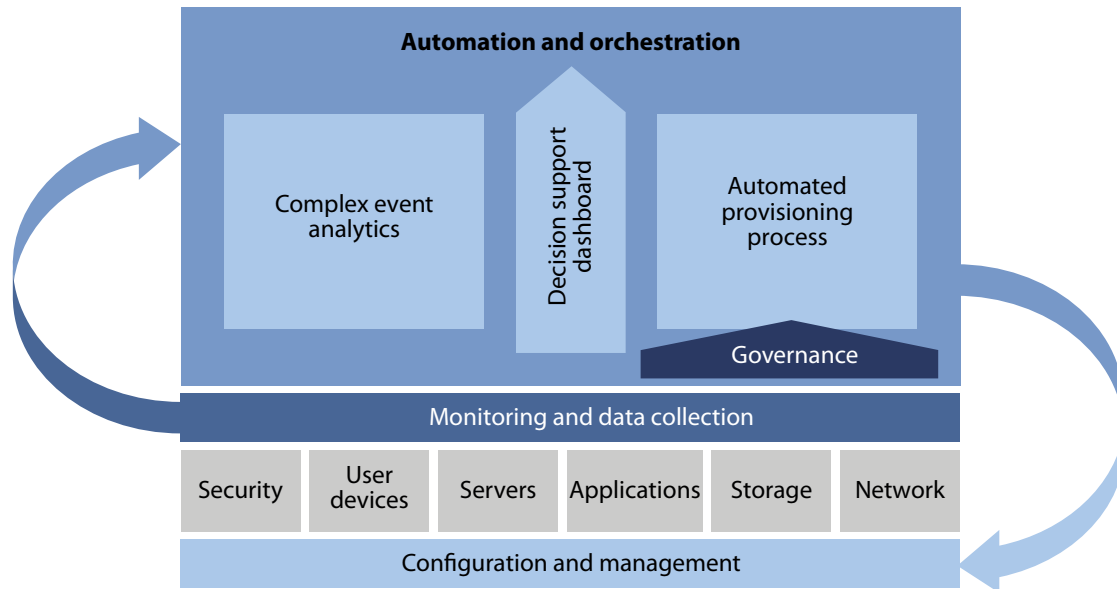
Open source distributions of Linux contain DHCP and DNS services. Novell's eDirectory and Microsoft's Windows 2000/Active Directory are bundled into other commercial software. These systems don't include the full range of services found in full-fledged IP address-management systems. The free aspects and rudimentary IP address-management capabilities have been a viable option for I&O to date. However, current IT initiatives are pushing requirements beyond the capabilities of these basic solutions. I&O teams need to source new solutions that will:

- **Enable I&O professionals to focus on their core competencies.** Every company needs DNS, DHCP, and IP address management. There isn't anything that can be customized for a particular business that will give it a competitive edge. Fundamentally, commercial solutions offer more advantages: cost-effective packaged solutions leveraging existing technologies while removing the burden of internally developed resources; easy-to-use software packages; APIs that offer the flexibility and scalability of customization options; reusable components; integration with cross-functional processes; and automated and standardized design processes.
- **Automate mundane and repetitive functions by the technical elite.** The ROI on IP address-management systems, once implemented, comes mainly through efficiency gains both on the I&O side (reduction in manual labor) and the end user side (reduction in downtime). Operations

teams can place less expensive personnel in positions currently maintained by engineers or have larger pools of resources to draw from, since the need for specialized talent decreases.

- **Be deployed and managed on a plug-and-play basis.** A number of solutions that have been in the market for a long time were designed for large heterogeneous environments that support free products and didn't focus on quick implementation; scalability and functionality were considered much more important. However, the industry has evolved. Newer, converged solutions can be snapped into place and support the functions of the overall infrastructure.
- **Support ITIL and CMDB initiatives.** Addressing has a reach and impact far beyond the network domain. The viability of IT services dictates that such influencing factors are governed under the discipline of structured processes such as IT Infrastructure Library (ITIL). IPAM tool acts as a management data repository in the context of a configuration management database (CMDB) — or ITIL v3's more superior configuration management system (CMS) — and combined with other elements like network topology, server configurations, and application dependency maps.
- **Enable a distributed CMS model.** The CMS calls for federated data repositories and object-oriented assemblies of data into more useful abstractions at higher levels of relevance. This enables more accurate, real-time data to be maintained than is possible in a monolithic CMDB. Domain-specific discovery tools like those in DDI are invaluable, as they are a huge help in maintaining accuracy and are generally already robust (see Figure 2).

Figure 2 DDI Tools Should Plug Into A Broader Automation And Orchestration Architecture



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Source: Forrester Research, Inc.

Alcatel-Lucent, BlueCat Networks, BT Diamond, And Infoblox Provide Top DDI Solutions

Most early systems were overlays to DNS and DHCP systems with proprietary IPAM software, much akin to how best-of-breed network management was a proprietary overlay to routers and switches. New vendors have emerged with innovative solutions and more attractive pricing. The landscape is now dominated by Alcatel-Lucent, BlueCat Networks, BT Diamond IP, and Infoblox. Infoblox pioneered the appliance as a packaging model for DDI services, and now others have followed suit.

Other DDI companies — such as Men & Mice, EfficientIP, and Nominum — have lost their shine and have fallen off the list of most enterprise I&O shortlists. Each of the main players has its strengths and weaknesses, and I&O teams should select the vendor based on the following primary capabilities.

Alcatel-Lucent Offers Customization

Lucent (later merged with Alcatel) was once the undisputed leader in DDI solutions and remains vendor of choice for the service providers, but it has since declined in favor with enterprise I&O teams. Based on our client interactions, Alcatel-Lucent comes in at a distant third in the enterprise arena. This erosion seems to have leveled off with the renewed investment into the DDI division and Alcatel-Lucent's recent releases. The problem is that many I&O organizations don't know about some of the powerful enhancements to VitalQIP. Alcatel-Lucent's DDI division is one of the smallest divisions within the Alcatel-Lucent product portfolio, VitalQIP announcements get buried, and Alcatel-Lucent's website provides little information about the DDI solution.

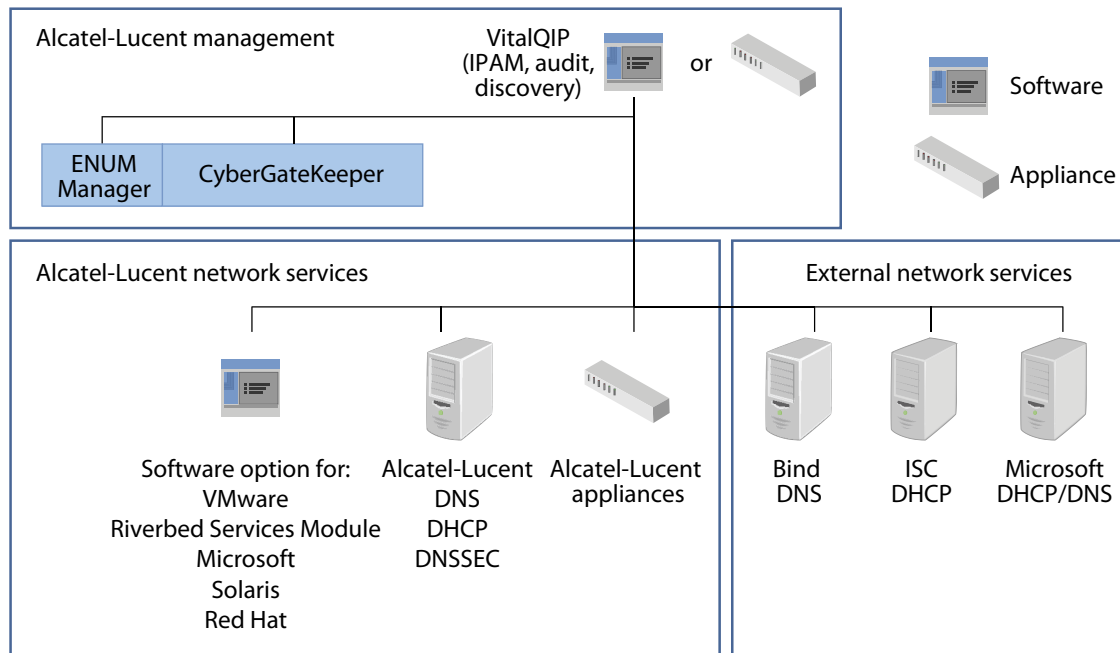
Putting awareness aside, Alcatel-Lucent brings a strong pedigree to the DHCP and DNS space, and its DDI offering, VitalQIP, helps I&O teams:

- **Deploy a flexible solution.** Alcatel-Lucent provides both a software solution, integrating multiple platforms like Bind DNS and Microsoft, and a full appliance-based solution that combines the hardware and software.
- **Scale to high transaction volumes.** Alcatel-Lucent effortlessly scales to more than 1 million addresses and is a favorite with service providers and carriers.
- **Support advanced communication capabilities.** VitalQIP provides a deep set of features for that market — whether it's responding to new technologies such as IPv6, VoIP, or ENUM; audit trail capabilities with a variety of reports; or providing tools, such as better Workflow Manager.

Although Alcatel has one of the largest global presences and distribution channels, I&O managers told Forrester there was a lot frustration around all the separate modules and the complexity to tie them together. Pressured by customers and competitors' all-in-one solutions, Alcatel-Lucent has recently combined Access Control, Address Allocation, Audit Manager, SNMP Module, and Service Manager into VitalQIP. Customers still need to upgrade to version 7 and buy API Toolkit, CyberGateKeeper, and ENUM Manager (see Figure 3). Forrester hasn't spoken to anyone who has moved away from Alcatel-Lucent's "kit car" versions previous to 7. I&O teams we spoke to found:

- **Investment has been a low priority.** I&O teams are hampered, because they get minimal or no exposure to new updates and tell us that VitalQIP services are poor.
- **Resources are limited.** Due to the overall revenue contribution, I&O members say they can't find the tools or personnel to support VitalQIP, which costs them more and sometimes delays projects.

Figure 3 Alcatel-Lucent Solution Taxonomy



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Source: Forrester Research, Inc.

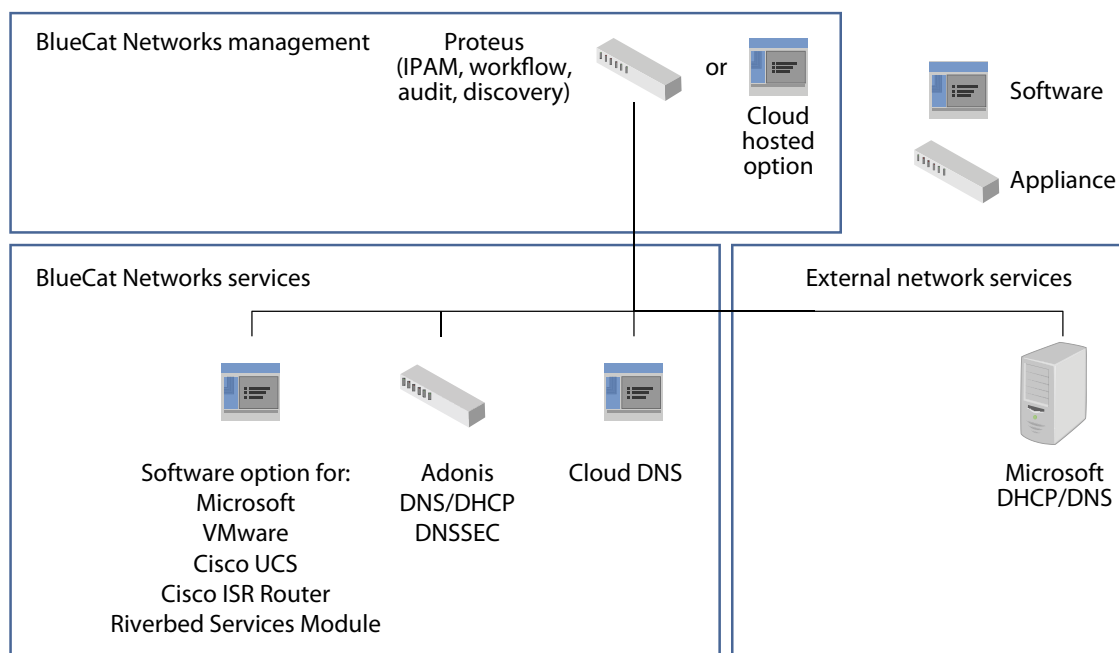
BlueCat Networks Simplifies And Focuses On DDI

BlueCat Networks is the youngest of the four vendors and is the second most referenced vendor during customer interactions. With its value proposition solely focused on the DDI space, its DNS/DHCP solution, Adonis, is an appliance solution based on open source code from ISC. Proteus, its IPAM part, is also an appliance, but like Adonis, can come in virtual form to sit on VMware, Microsoft Hyper-V, or Cisco's ISR routers and UCS Express. Proteus manages Adonis and Microsoft DNS and DHCP (see Figure 4). BlueCat Networks has been the go-to DDI vendor for enterprise I&O because of its ease-of-use solutions, simple and clear product catalog, and focus on partnering with incumbent infrastructure suppliers like HP, Cisco, BMC, IBM, and Microsoft.

Proteus' web-based interface is a purpose-built appliance based on an optimized firewall-grade operating system that allows customized configurations for different roles and policies. Users can tie Proteus into orchestration or management software with its SOAP API. BlueCat Networks' solution enables operations teams to:

- **Manage from a single console.** Network administrators can eliminate waste associated with using multiple tools and manage IP addresses, multiple domains, and DNS and DHCP services from a single appliance.

Figure 4 BlueCat Networks Solution Taxonomy



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Source: Forrester Research, Inc.

- **Reduce downtime.** Administrators can check DNS records syntactically and logically prior to configuration deployment, enabling administrators to edit any portion of the configuration before deployment. All links are verified with Proteus' live data-checking feature.
- **Meet regulations.** Security personnel can audit transactions made by administrations, and operations personnel can set conditions to ensure DNS configurations are carried out correctly.

BlueCat Networks has grown out of serving the US federal government, which aligns them well with customers who are concerned about security and regulation. But BlueCat Networks is a young, small company, ripe for acquisition. It has some growing to do, and I&O clients tell us that it needs to improve:

- **Virtualization integration.** I&O teams that are working to automate their data center will be shackled to a few one-offs, because BlueCat Networks lacks complete integration with virtualization management software like VMware's vCenter, Microsoft Hyper-V, or Citrix XenServer.
- **Distribution channels.** Right now, BlueCat Networks has limited reach in North America and lacks channel strength and support that other vendors bring to the table. Global I&O teams will have to consider their purchasing and service methods to see if BlueCat Networks can align to business processes like local sourcing.

BT Diamond IP Provides Managed DDI Services

BT's DDI capability was acquired when it picked up INS in 2007. This gave BT the ability to penetrate the US enterprise market and expand its service portfolio worldwide to better address the needs of enterprise I&O teams. BT now offers a combination of on-site consulting and remote management services to address DDI requirements. As a result, BT has evolved its Diamond portfolio from an overlay to a combination of overlay software and its Sapphire appliance series.

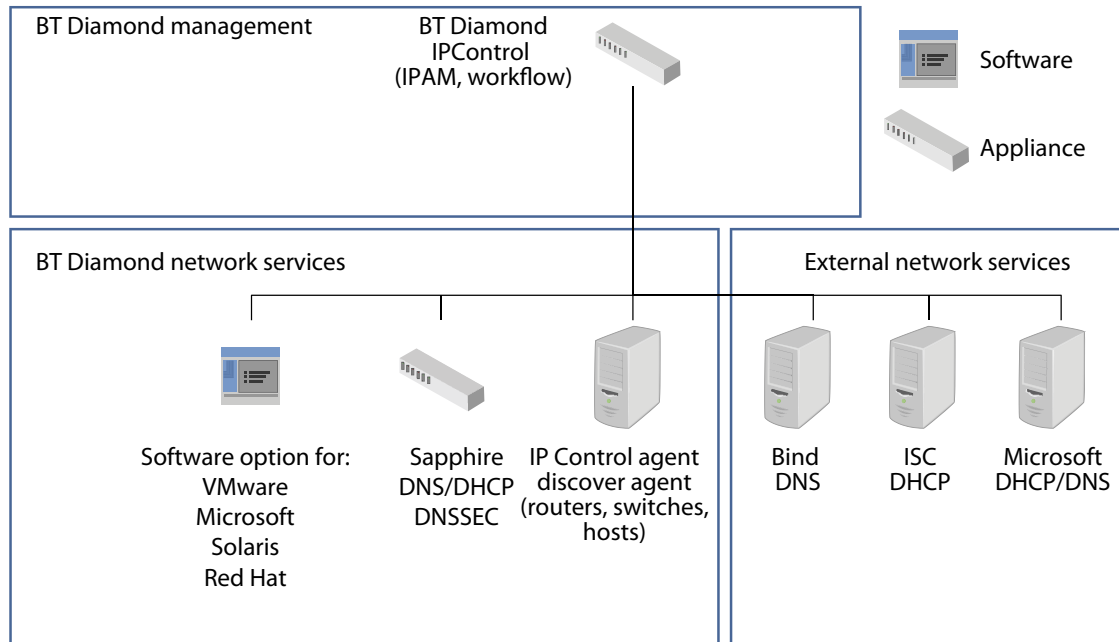
The Diamond IP solution has evolved to become one of the most flexible and scalable solutions on the market. Similar to how a switch interacts with network management software, BT is broken into two levels: IP control and the IP services (see Figure 5). IPControl Executive comes in software or appliance form factors and provides two capabilities. It: 1) discovers, identifies, and assures the accuracy of an enterprise IPAM inventory; and then 2) creates DHCP and DNS server configuration files or DNS resource record updates, which can be deployed on distributed DHCP and DNS servers. The Diamond IP architecture allows I&O organizations to:

- **Incorporate data collection from routers, DHCP servers, and ping sweeps.** With multiple methods of discovery, I&O will improve efficiencies by reducing the time to manually add missed components.
- **Leverage their investments.** I&O managers can use a single console to configure and manage BIND DNS, ISC DHCP, Microsoft DHCP, and BT's Sapphire solution.
- **Customize their DDI solution for their environment.** I&O managers will have significant customization capabilities with a rich set of tools to leverage, such as Interface IP control with XML/HTTPS API, and be able to use MySQL, MyODBC, and Oracle DBs on Solaris, Windows, or Red Hat platforms.

BT Diamond IP gives BT services teams a platform to support any enterprise at any stage of DDI deployment, but it's pricey and complex. BT Diamond has other shortcomings, such as:

- **Complex integration process.** Unlike other solutions that offer a plug-and-play environment, organizations will need to spend a significant amount of time integrating all the components, and they will see longer maintenance cycles during upgrades; the lack of standardization increases one-off processing.
- **Minimal automation functionality.** I&O operations won't find the automation functionality they need if they're in the process of creating a self-service infrastructure. Most of the functionality will have to be created through scripting.

Figure 5 BT Diamond IP Solution Taxonomy



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Source: Forrester Research, Inc.

Infoblox Automates The Network

As the largest and, therefore, the most referenced vendor in the DDI space, Infoblox revolutionized the industry by delivering the first DDI appliance. Since then it has extended DDI management to Microsoft DNS/DHCP and created virtual instances for Riverbed Technology's Steelhead services platform, Cisco ISR routers, and VMware (see Figure 6). I&O teams favored Infoblox because it offered standardized hardware with an easy-to-use interface, role-based access, workflow process and auditing trail capabilities, and centralized control that helped to automate tasks that were once very manual; the Infoblox VMware plug-in allows IP addresses to be assigned within vCenter Orchestrator to a virtual machine with a couple of clicks.

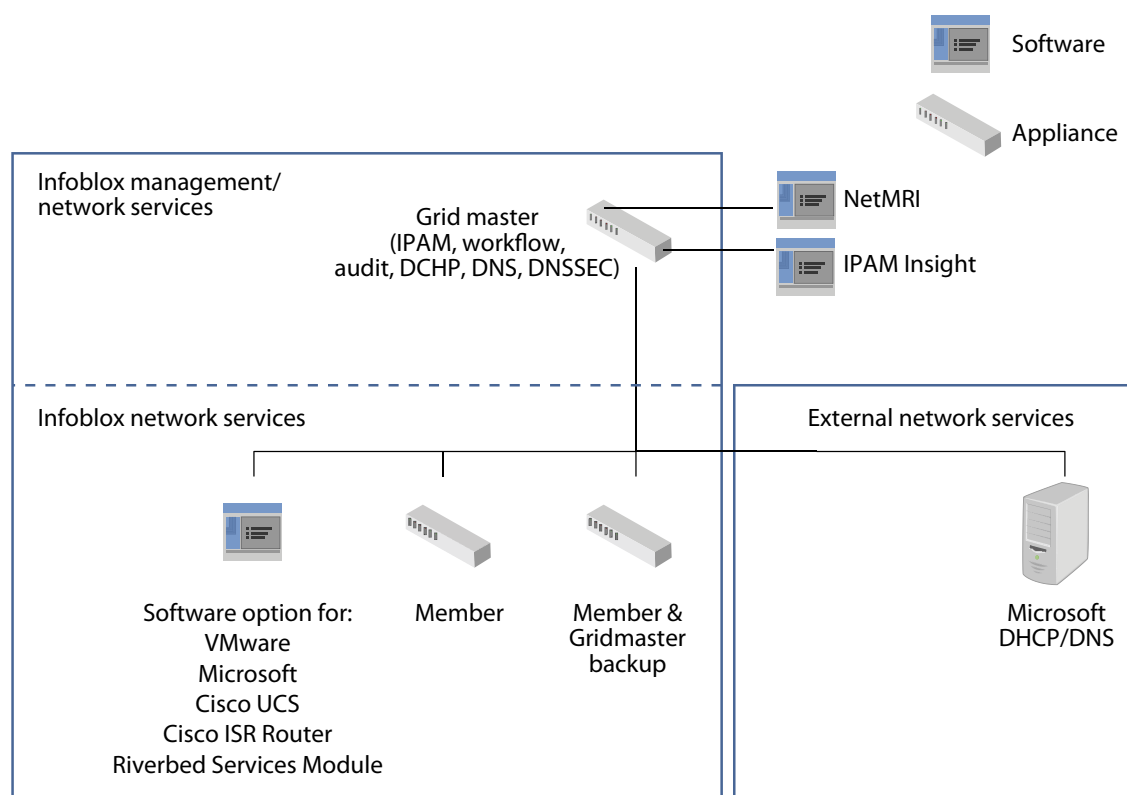
The foundation of its success comes from the architecture and hiding complexity with automation. Infoblox appliances can interface with each other in what is known as "grid technology." Multiple appliances can communicate with each other and provide high availability. This shared information base provides I&O engineers with a state of all defined networks and utilization rates through graphical mappings, management of overlapping address space, and visibility of unused addresses. Wizards help simplify tasks. Infoblox's DDI solution helps I&O teams:

- **Simplify operations.** The single unified management interface and shared database provides real-time, detailed network discovery and visibility into the heterogeneous physical and virtual network elements at Layer 2 and Layer 3. DDI personnel will benefit from a reduction in operational tasks while having more information available in one location.
- **Reduce the need for certain networking tools.** With the PortIQ appliance, IPAM functionality and network management are linked together to provide visibility into switch port use for port capacity planning, security audits, and troubleshooting.
- **Accelerate hardware convergence.** Infoblox has strong partnerships with market leaders like Riverbed, Cisco, and VMware. I&O teams that are consolidating hardware and software will benefit from Infoblox being ported to Riverbed's services module, Cisco's ISR services blade, and VMware's virtual software.

As with any market leader, Infoblox has started to move in adjacent markets to help hide network management complexity. Cisco, Nortel, and 3Com have dived into adjacencies and lost focus on their core competency. Even though strategically Infoblox's vision is cutting-edge, I&O managers should be concerned that the company could be spreading its resources too thin across its DDI solution and its purchase, Netcordia, a network management solution. In addition, I&O managers should be concerned with:

- **The lack of orchestration partners.** Infoblox hasn't spent the time working with larger management companies like HP, IBM, EMC, and CA. I&O managers will have a harder time connecting DDI into their orchestration tools. It will require a little more coding to connect them.
- **The growth of bolt-on options.** Infoblox made a name for itself because everything existed within grid appliances. As Infoblox has come out with more functionality, I&O managers will notice more options that need to be bolted on and not turned on. Some interfaces lack consistent feel and functionality, which can affect operational efficiency as one-offs are executed.

Figure 6 Infoblox Solution Taxonomy



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Source: Forrester Research, Inc.

RECOMMENDATIONS

DEPLOY DDI AS A FOUNDATION FOR BROADER INFRASTRUCTURE EFFICIENCIES

From mobile devices to customized services, I&O teams have a lot of sophisticated and complex projects on their plate. Deploying a commercial DDI solution allows I&O to focus efforts on industrializing network processes, which brings important productivity and quality gains to operations and allows for resources to be shifted to the new projects. Forrester has found that I&O teams that have transitioned from homegrown solutions have reported huge ROI — typically between 150% and 500% over three years — when they stop handling IP and DNS manually and go to a commercial DDI solution. To maximize the benefits associated with a commercial DDI solution, I&O leaders must prepare for a new wave of converged and integrated automation solutions. To get prepared, you must:

- **Avoid burying your head in the sand.** Just because it seems to be working doesn't mean your current DDI deployment is efficient and will support your business strategy over the next five years. DDI isn't as sexy as virtualization, but I&O managers won't get all the data center transformation efficiencies they expect if the fundamentals aren't there. You'll know you need a commercial DDI solution if the combined time your I&O staff spends on DNS, DNCP, and IP issues adds up to more than two full-time employees.
- **Recognize the core competency of the organization.** Chances are that developing and managing a homegrown solution does not give your company any competitive advantage. Focus instead on creating and delivering value to your customers as core competencies. Free up the cycles to do so by leveraging the development and support resources of commercial DDI solutions.
- **Standardize and consolidate operational processes.** As with goals in branch office and data center consolidation, consolidating variances of DNS and DHCP products enables workloads to be automated or shifted to lower costs. IP address management systems fit well within the overall quest for cost reduction through automation. Automation can only occur through relentless industrialization of operations, which is often the biggest hurdle for many who have gotten comfortable.
- **Select solutions carefully.** All automation products are going to evolve fundamentally within the next 12 to 18 months as witnessed by the recent acquisitions of automation and management companies by big vendors who are looking to automate the data center. They know software and management are the new battlegrounds. I&O leaders who want to reach the ultimate stage of flexibility through automation must make sure that the solutions are in alignment with their orchestration management strategy.

ENDNOTES

- 1 As a result, businesses are demanding that IT departments respond by helping them achieve two goals: embed themselves in their customers' lives and offer personalized products and services. For more information, see the June 21, 2011, "[Why I&O Must Design A WLAN To Provide The Best User Experience](#)" report.
- 2 Infrastructures weren't designed to support companies that are creating personalized products and services. This customization strategy requires supporting empowered employees with on-demand services. Forrester believes that network infrastructure is a critical component in ensuring a proper user experience. We refer to this as the user experience network (uXn). For more information, see the June 21, 2011, "[Why I&O Must Design A WLAN To Provide The Best User Experience](#)" report.
- 3 Today's application delivery networks must be transformed into uXns. As with the web, enterprise networks will be understood not as a single instance solving a specific issue but as a fluid and intertwined set of functions leveraging the most optimized set of capabilities and resources for the users. Forrester defines a uXn as: A network architecture that focuses on monitoring, controlling, and optimizing the quality of user experience. For more information, see the February 17, 2011, "[Focus Your Network Strategy On User Experience, Not Application Delivery](#)" report.

- 4 Post-recession economics, combined with ever-expanding technology complexity, are quickly rendering established IT systems and operations obsolete and impractical. Follow the lessons of other business movements that have industrialized their processes to achieve more efficient business outcomes and sustainable competitive advantage. Your industrialization efforts must focus on three core objectives: high productivity, high quality, and high flexibility. See the February 7, 2011, "[Prepare For The Industrial Revolution Of I&O](#)" report.
- 5 "But addresses are not uniformly distributed. There is a digital divide between western countries and developing countries. The top user (not counting some mini-states) is the US, where wasteful pre-CIDR address allocations have led to an average of more than 4 addresses per person." Source: Peter HJ van Eijk, "The Digital Divide on IP Addresses," *CircleID*, May 24, 2010 (http://www.circleid.com/posts/20100524_the_digital_divide_on_ip_addresses/).
- 6 "Anyone can send a response to a DNS request, but if you don't have the right query ID, your response is ignored. Essentially, it's a race. To hijack someone, you need to send the wrong IP address, with right query ID, before the correct address gets there. Until now, this model has protected online surfers reasonably well because the chance of a guessed QID arriving before the legitimate one shows up are improbably small." Source: Alistair Croll, "The Kaminsky Hack: DNS Exploits in the Wild," *GigaOM*, July 22, 2008 (<http://gigaom.com/2008/07/22/the-kaminsky-hack-dns-exploits-in-the-wild/>).

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