

# Assigning and Managing IPv6 Addresses in Higher Education Environments

Infoblox and the University of New Hampshire



**University of  
New Hampshire**

## Executive Summary

The University of New Hampshire (UNH) is the state's flagship institution, with campuses in Manchester, Durham, and Concord. As New Hampshire's public research university, UNH holds land-grant, sea-grant, and space-grant charters, and has over 1,000 teaching and research faculty and more than 17,000 students. In 2016, UNH upgraded its student residential wireless network, and used the upgrade as an opportunity to implement and take control of its IPv6 addressing and management.

Utilizing Infoblox DDI (including IPAM for IPv6, IPv6 DNS, and DHCPv6), the university's IT team achieved:

- Error-free management of complex IPv6 host addresses
- Simpler IPv6 address routing and allocation
- Integrated management of dual-stack hosts with DHCPv6 and IPv6 DNS support
- Confidence in the university's ability to expand its IPv6 implementation going forward

All modern computing systems enable and prefer IPv6 by default. Content providers, Internet service providers (ISPs), and mobile carriers are constantly increasing their IPv6 deployments. For example, over 70 percent of Verizon's network traffic is IPv6 and Cisco predicts that IPv6 traffic on the Internet will exceed 50 percent by 2018. Public IPv4 addressing cannot sustain the burgeoning growth of networks, and NAT deployments relying on RFC1918 (private) addressing do nothing to manage and secure the IPv6 that's already running internally on all modern enterprise networks.



At the University of New Hampshire, the school's IT professionals understand the importance of embracing IPv6. "We support all aspects of higher education at the University of New Hampshire," says IT Internet director Scott Kitterman, "and part of our commitment to our community is to provide up-to-date tools, services, and capabilities that will allow them to learn, teach, and be ready to make a difference in their prospective fields of work. The use of IPv6 over the local-area networks and the Internet is only going to grow and people, consumers, and maintainers of networks need to have access to it to experience the benefits of modern networks."

Like other enterprises adopting IPv6, UNH faced several challenges, including the need to support dual-stack hosts with both DHCPv6 and IPv6 DNS. UNH also needed to be able to effectively manage and assign IPv6 addresses and prefixes. The length and complexity of the IPv6 address make this difficult to do accurately and quickly using legacy tools (e.g., spreadsheets). Infoblox IPAM provides both error-free address tracking and easy address planning for IPv6.

## Infoblox DDI: Feature and Functional Parity for IPv6 (including DNS)

UNH was already using Infoblox IPAM for its legacy IPv4 deployment. Kitterman explains:

"Since the initial implementation, UNH integrated DHCP, DNS, and legacy IPv4 addresses into a single system to take advantage of the easy-to-use IPAM view for overall visibility. The Infoblox system has allowed the UNH IT team to delegate network resources to various teams and groups within both UNH and the University System of New Hampshire that manage groups of systems, various subdomains and subnets.

"For example, the network team that is responsible for the network edge infrastructure manages their systems in sub-domains, assigning access points, edge switches, and management systems with DHCP resources that are fully integrated into DNS through Dynamic DNS. This offers an easy, single point of network resource deployment and continuous management of IP addresses which includes the metadata surrounding the edge equipment.

"It is a win-win as the network team can control their IPAM resources, leaving the network service managers more time to focus on other aspects of DNS/DHCP and IPAM growth. The infrastructure and capabilities of Infoblox allow these various configurations and delegations to streamline the workflow, offering scalable and flexible benefits to all involved.

"Overall, Infoblox is used to support upwards of 30,000 active client addresses daily, as well as a large transient population of wireless devices, through several hundred sub-domains and networks."

Kitterman goes on to describe the deployment of IPv6 and how Infoblox DDI, including its full support for IPv6 DNS, made it more manageable:

"These features and methods have allowed UNH to plan and implement the same level of service and flexibility into their IPv6 deployment and on-going growth of IPv6 services. UNH knows that it cannot ignore IPv6 as it will enable growth in education and services provided as more and more devices come on the network every day.



“Infoblox services are even more valuable in the planning, design, and deployment of IPv6 services. All the same features in IPv4 legacy network support are available in IPv6. At present, the UNH IT network engineers are supporting IPv6 service for around 2,000 servers and end stations in dual-stack environments. UNH Infoblox servers have been running IPv6 interfaces since day one of installation. The same IPAM, DNS, and DHCP integration used in legacy IPv4 services fits nicely onto the IPv6 design and support methods. UNH manages several IT support IPv6 networks and management subnets in dual-stack mode through the capabilities of Infoblox. Dual stack is supporting public desktop clusters of approximately 600 desktops for student use 24 hours a day.

“These systems take advantage of dual stack environments that provide two separate paths to the Internet over the IPv6 or IPv4 routing infrastructure. Both IPv6 and IPv4 have accurate and public DNS assignments that can be important in many aspects of network management, access control, and reliable service. The same techniques in IPv4 are fit into IPv6 deployments, making support of IP resources easy to deploy and just as scalable as the legacy design. UNH supports dual stack and subdomain in data center networks as well, giving system administrators the tools and access to Infoblox, allowing management of all aspects of their network resource needs. The more the network grows, the easier it becomes using the tools that Infoblox DDI provides.”

### Infoblox IPv6 IPAM and Address Allocations: Easy to Design, Even Easier to Communicate

Kitterman and the team at UNH realized that the feature and functional parity offered by Infoblox IPAM for IPv6 would allow IPv6 addresses and ranges to be efficiently and accurately deployed and managed. According to Kitterman, the support of IPv6 in Infoblox IPAM allows UNH “to track resource availability pretty much the same as we’ve been doing with IPv4. There are some differences to take into consideration such as address size and structure. In the beginning it is a little extra work up front to get started. But it was much more effective than ignoring and not supporting IPv6.”

Per Kitterman, Infoblox IPAM capabilities for IPv6 addressing made IPv6 address planning and subsequent allocation easy to design. Infoblox’s IPv6 IPAM also made it easier to explain the IPv6 address plan to peers and to IT staff outside the networking team, such as system and application administrators.

“The big win is that, through Infoblox, IPv6 address planning and delegation become easier than growing out an existing IPv4 IP management scheme that has grown over a few decades. It is a great time to get a clean refresh on the network design. Not only does Infoblox make it easy to create an IPv6 address plan, it offers sanity checks through the IPAM features as network blocks are divided just the same as in IPv4, which is a huge bonus while UNH is planning and preparing for the IoT boom and wireless growth.

“UNH received a /32 from ARIN and sliced it into 4 /34 allocations: One for the LAN campus networks to service the general UNH population computing needs, one for departments, one for the USNH system consisting of statewide colleges and other educational entities such as Cooperative Extension, and the last block to serve New Hampshire community connectivity networks to UNH resources.

“On the local campus, current allocations are half a dozen /64 networks currently serving or in place to serve wired network services in a dual stack mode. A /48 is in place and testing public



wireless service. A /60 serves test networks used in IT bachelor program senior projects. There is also a /48 assigned for point-to-point WAN connections as well as a /64 serving campus Content Delivery Network. Allocations of a /44 serving the IOL, a /48 serving the Research Computing Department, and a /48 serving the Computer Science Department.

“The design will keep the IPv6 backbone to a minimal number of routes. Most IPv4 network designers will be very envious of the simple layout. The Infoblox IPv6 hierarchical IPAM makes this easy to design, deploy, and explain. The flow is so much more convenient than that of IPv4 deployments. Once network managers go down this road, they will be asking why they did not do this sooner!”

## Leveraging DHCPv6 to Manage Dual-stack Hosts

Another advantage of the Infoblox DDI solution is its DHCPv6 services, which UNH is using in conjunction with DNS sub-domains and Dynamic DNS. In general, Dynamic DNS works very well between DHCP and DNS with or without client hostnames provided in client DHCP transactions. The services themselves are extremely reliable.

By leveraging Infoblox IPAM support for IPv6, UNH could achieve—and even improve—IPv6 feature and functional parity with its existing IPv4 deployments, including services and management practices.

In the past, UNH used native ISC BIND and DHCP daemons extensively, which would work, but needed at least one person to have detailed knowledge, and required extreme attention to detail in managing both DHCP and named BIND configurations without any IPAM tools. “Now IPv6 DNS service is easy to manage from the Infoblox GUI and APIs,” says Kitterman. Infoblox also allows UNH to delegate DNS record management and reporting features to various system administrators and managers, which was not an option in the old model of DHCP and NAMED via ISC packages.

“The integration between IPAM DHCPv6 and Dynamic DNS features have been exceptionally helpful in the networks serving clients,” says Kitterman. “Integration allows public cluster computers to take full advantage of dual-stack IP assignments by placing IPv4 and IPv6 into separate domains, working seamlessly from the end-user perspective while allowing IT staff to see each IP assignment resource allocated.”

## No Reason to Hesitate with IPv6 Adoption

Ongoing, incremental IPv6 deployment has given UNH confidence in its ability to effectively support and expand its IPv6 footprint going forward. “We did this,” says Kitterman, “and others can as well, by starting in a small controlled environment. Getting started did not take much time or effort. Building out from the very confined test network into the enterprise has been a progressive and steady evolution. IPv6 is not going to be any harder than IPv4 in current environments.”

And he points out that the benefits of IPv6 are already being felt on campus. “One of the best parts of deploying IPv6 has been that our value-added resource provider, Optiv, is deploying IPv6 dual-stack in their LAB network managed by former UNH students who worked on IPv6 projects with UNH IT staff. Both Optiv and Infoblox teams have been key resources and invaluable in our effort.” This forward-leaning effort to adopt IPv6 today, aided by Infoblox IPAM, will prepare students and staff in Information Systems and beyond to effectively deploy, manage, and use the Internet protocol of tomorrow.



## About Infoblox

Infoblox delivers Actionable Network Intelligence to enterprises, government agencies, and service providers around the world. As the industry leader in DNS, DHCP, and IP address management (DDI), Infoblox provides control and security from the core—empowering thousands of organizations to increase efficiency and visibility, reduce risk, and improve customer experience.

### CORPORATE HEADQUARTERS

+1.408.986.4000

+1.866.463.6256

(toll-free, U.S. and Canada)

[info@infoblox.com](mailto:info@infoblox.com)

[www.infoblox.com](http://www.infoblox.com)

### EMEA HEADQUARTERS

+32.3.259.04.30

[info-emea@infoblox.com](mailto:info-emea@infoblox.com)

### APAC HEADQUARTERS

+852.3793.3428

[sales-apac@infoblox.com](mailto:sales-apac@infoblox.com)