# Chapter XXXIV
# IP Address Management: Challenges, Solutions and Future Perspectives

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## ABSTRACT

*IP network connectivity is becoming so important for business that it is being compared today to basic utilities, such as water and electricity. As key enablers of IP network connectivity, IP addresses are positioned today among the most important resources to be managed. Ready access and flawless handling of IP address usage, assignment, tracking and reallocation help in enhancing network reliability and security, while enabling more efficient network expansion and troubleshooting. Today, more than any time before, companies are realizing the need to adopt and implement a comprehensive IP Address Management (IPAM) strategy. Such a strategy, backed by automated IPAM tools, will enable organizations to address the stringent requirements imposed by new converged technologies. This chapter turns the spotlight on the most important challenges in IPAM and attempts to address some of the solutions and best practices to tackle these challenges. The author's views on future IPAM perspectives are discussed and some open research issues are pointed out. The paper underlines the need for organizations to adopt proven IPAM best practices and deploy good automated IPAM tools. This will put them in a better position to expand and leverage their existing networks, while optimizing their IP address space in a secured and controlled fashion.*

## INTRODUCTION

Most organizations today, whether carriers, service providers or enterprises, rely on IP -based networks to service their information processing and communication needs. Core business applications such as enterprise collaboration, electronic-commerce and internal business operations rely on network integrity, availability, and reliability. IP-centric networks will become even more important with the ongoing integration of converged data, voice and video services

over a unified IP-based network infrastructure. The recent proliferation of IP-based devices such as IP phones, wireless PDAs, access devices and RFID readers is further amplifying the role of IP-based networks in enabling next-generation services such as enterprise mobility and mixed-mode unified communications. As a result, IP network connectivity is becoming so vital for business that it is being compared to utilities such as water and electricity (Liu, 2005). As key network connectivity enablers, IP addresses turn out to be one of the most strategic resources to be managed in modern networks.

Broadly speaking, IP Address Management (IPAM) can be defined as an ongoing practice which deals with the proper allocation, assignment, tracking and reallocation of IP addresses. To achieve these tasks, organizations need to formalize and adopt comprehensive IPAM strategies that best suit their needs. As shown in Figure 1, this IPAM strategy spans across three unified management functions, namely IP Address Inventory Management, Domain Name Service (DNS) management and Dynamic Host Configuration Protocol (DHCP) management (Kerravala, 2005). Each of these functions is essential for the proper operation of an IP network, as detailed below.

*IP address inventory management* provides the ability to remotely handle the allocation of IP addresses within the organization's IP address space. This function is also responsible for archiving IP inventory data and for optimizing usage of the IP space.

*DNS management* handles the proper configuration of DNS servers, based on best practices. The objective is to keep DNS servers highly secure and available, while keeping DNS configuration data sanitized from syntactical and logical errors ("IP address management demands," 2007).

*DHCP management* enables the assignment of static and dynamic IP addresses, ensuring that these are available on the fly to authorized hosts that require connection to the network. This requires the proper configuration and provisioning of DHCP servers to maintain their security, integrity, and availability. DHCP management also aims to automate and optimize the usage of the scarce IP address space.

Today, a new breed of IPAM solutions is being proposed, with a promise to automate and optimize the management of the IP address space throughout the IPAM lifecycle, as shown in Figure 2. Some of the strategic tools offered by these IPAM solutions include centralized management and automated provisioning, auditing, diagnostics and reporting. Automation is a key success factor in delivering efficient IPAM solutions that are scalable, flexible and secure and which are capable

*Figure 1. IPAM functions and associated four functional areas*