Transition from IPv4 to All-IPv6 Networks Transparently and with the Lowest TCO

Challenge:

Across the world, IPv4 addresses are now depleted and it is time transition to IPv6. While IPv6 brings forth many advanced capabilities—in addition to a very large address space—it is not backward compatible with IPv4. A successful migration from IPv4 to IPv6 should include a careful planning to ensure that all the end-user devices, application servers, and existing network elements continue to operate seamlessly.

This solution brief discusses the general requirements that should be considered during the planning phase and specifically, how A10 CGN solution can help reduce cost and future-proof the investment.

Solution:

Regardless of the models, all Thunder CGN appliances from A10 come with the highest performance, largest service scalability and most comprehensive IPv6 transition options to meet the requirements of the largest service provider networks without comprising compatibility.

Benefits:

- Clear advantages over IP router-based CGN
- Big cost savings
- Integrated DDoS protection
- Ease of use and management

Unprecedented growth in mobile devices and subscribers in recent years has caused service providers to make significant investments in infrastructure to support rapid data traffic growth and offer new services. This growth in connectivity has contributed to the exhaustion of the IPv4 address space, and the depletion of IPv4 addresses is now a reality.

On September 25, 2015, ARIN (American Registry for Internet Numbers) announced that the IPv4 addresses in the U.S. were completely depleted and it is now time to move to IPv6. This was not surprising as several similar events already occurred globally, starting with regions where there are high population densities and rapid adoption of mobile technologies. In 2011, Asia Pacific was the first one to run out of the IPv4 addresses, followed shortly by Europe in 2012 and South America in 2014.

As digital content and Internet traffic are growing exponentially, the emerging trend of the Internet of Things (IoT) is causing the number of connected devices to cross 20 billion by the end of this decade, increasing the demand for even more IP addresses. In order to sustain current users and prepare for long-term growth, migrating to IPv6 has become inevitable for service providers.

Since IPv6 is not backward compatible with IPv4, service providers will have to plan for the coexistence of IPv4 and IPv6 networks to ensure business continuity and prepare for future growth. A10 Networks® Thunder® CGN line of Carrier Grade Networking gateways offers comprehensive IPv4 to IPv6 migration solutions, allowing service providers to extend their investments in IPv4 infrastructure while allowing for transitions to newer IPv6 infrastructure.

Figure 1: IPv6 and IPv4 incompatibility

The Challenge

Rapid proliferation of Internet-connected devices has depleted the available IPv4 address space and service providers still have to meet the increasing demand for IP connectivity. Migrating to IPv6 will certainly help service providers to pave the foundation for growth, but an overnight transition to IPv6 is not realistic. Transitioning from IPv4 to IPv6 comes with challenges. For one, IPv6 is not backward compatible with IPv4 and secondly, the address translation process tends to break certain applications and protocols. Assurance of compatibility and application reliability are top of mind for service providers. Disruption to existing business is not an option for any network

modernization project because existing Service Level Agreements (SLAs) to its customers must be maintained. The three points below outlined the requirements that should be included with any IPv6 transition:

- **Preserve existing investments:** Service providers have a very large installed base of IPv4 infrastructure and they want to preserve their existing investments; avoid costly, disruptive replacements; and be able to expand services in future.
- **Prepare for future subscriber growth:** Service providers are also looking for definitive ways to address the growing demand for IP connectivity. As they prepare to migrate to IPv6 for scalability reasons, they want to ensure a smooth evolution and overcome the compatibility issues with the older IPv4 protocol.
- **Maintain Service Level Agreements:** Service providers are heavily dependent on the availability of their services. Service downtime is not acceptable; it leads to immediate revenue loss, customer satisfaction issues and damage to reputation. As customers evolve the network architecture, they want to maintain current applications and meet SLAs.

The A10 Networks Thunder CGN Solution

The A10 Thunder CGN line of Carrier Grade Networking gateways provides high-performance, highly transparent address and protocol translation that allows service providers to extend their IPv4 network connectivity while simultaneously making the transition to IPv6.

Thunder CGN products are built upon A10 Networks Advanced Core Operating System (ACOS®) architecture that delivers high performance, scalability and a wide range of features for enhanced service availability, IPv4 preservation, IPv6 transition and security.

Extend IPv4

The Thunder CGN product line supports standards-based Carrier Grade NAT (CGNAT). CGNAT mitigates IPv4 address exhaustion by using address and port translation in large scale to extend the life of an IPv4 network infrastructure.

Typically, the ratio of private to public addresses can be very high and it is resource intensive to perform address translations simultaneously for many users in a service provider environment. A10 Thunder CGN products are purpose-built to deliver a high-performance, scalable CGNAT solution in efficient form factors. In addition, Thunder CGN supports advanced logging features to trace user connection details to maintain compliance and regulatory requirements.

As described in Figure 2, Thunder CGN allows service providers to extend the lifetime of their current IPv4 infrastructure, save cost and gain time to plan their IPv6 transition strategy.

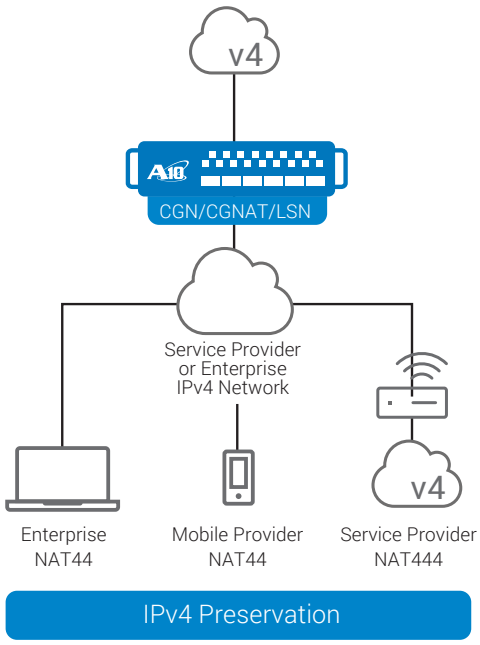

Figure 2: CGNAT deployment options

Application Reliability

The A10 Thunder CGN product line provides application availability and connection reliability so that applications will remain addressable and operate transparently through the address translation process.

Many applications still rely on network transport information to operate. Applications, that embed network and other information in the IP packet payload, tend to break with address translation. A10 provides a comprehensive list of application layer gateways (ALGs) to ensure that protocols like FTP, TFTP, RSTP, PPTP, SIP, ICMP, DNS and H.323 remain functional even when subjected to NAT. In addition, advanced features such as Endpoint Independent Mapping (EIM) and hairpinning ensure predictable NAT behavior to provide a transparent end-user experience.

Applications can also break when network connections switch over between devices due to failures. Thunder CGN devices, when deployed in high availability (HA) mode, allow established sessions to be maintained during any failover, and this is completely unnoticeable to end users. The high connection reliability of Thunder CGN provides service providers a cost-effective solution to meet SLAs and user satisfaction goals.

Broad IPv6 Transition Options

Service provider networks are very diverse and often require different transition technologies to be deployed simultaneously. The Thunder CGN product line provides a wide choice of technologies that enable a smooth transition to IPv6 networks as shown in Figure 3.

- IPv6-only access networks can use technologies like Dual-Stack Lite (DS-Lite) allowing IPv4-only devices to access the Internet using softwires (or tunnels) through the IPv6-only infrastructure. Light Weight 4 over 6 (LW4o6) or IPv6 Rapid Deployment (6rd) provide similar behavior, allowing alternate IP versions access through the network. MAP-T is a translation technique which builds on the Address plus Port method of stateless NAT to translate packets between IPv4 and IPv6 networks.

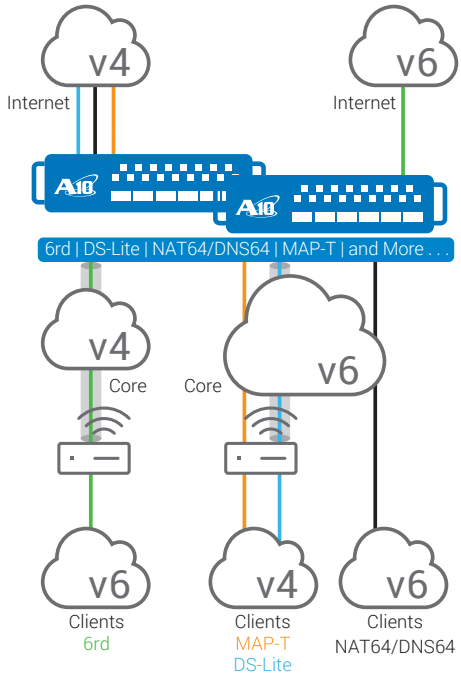

Figure 3: IPv6 transition options

- IPv6 Rapid Deployment (6rd) and Light Weight 4 over 6 (LW4o6) provide similar connectivity, allowing IPv6 devices access over an IPv4-only core.
- IPv6-only devices need a way to access IPv4 content, and NAT64/DNS64 features solve the problem by interfacing between the IPv4-only content, and native IPv6 clients.

Thunder CGN also ensures that customers can deploy any transition technology as well as providing the seamless interplay between these technologies. For example, users can start with CGNAT to immediately mitigate IPv4 address exhaustion and then phase in NAT64/DNS64 to enable IPv6 clients to access the IPv4-based Internet.

To summarize, A10 Thunder CGN products offer a comprehensive feature set consisting of CGNAT functions, ALGs and many IPv6 migration techniques in a single device. Figure 4 provides a summary of all IPv4 extension and IPv6 migration features supported on A10 Thunder CGN.

Features and Benefits

A10 can confidently claim that the Thunder CGN appliances offer the industry highest performance and broadest range of physical, virtual and hybrid CGN platform options. When coupled with the ACOS operating system, the performance and scalability far exceed the CGN capability of the previous generation networking platforms.

The section below is dedicated to illustrate the points.

Clear Advantages Over IP Router-Based CGN

Unlike proprietary-based networking equipment, CGNAT and IPv4/IPv6 translations need to analyze deeply into the data packets. This process is very resource intensive and requires an array of high-performance engines as part of the basic CGN architecture.

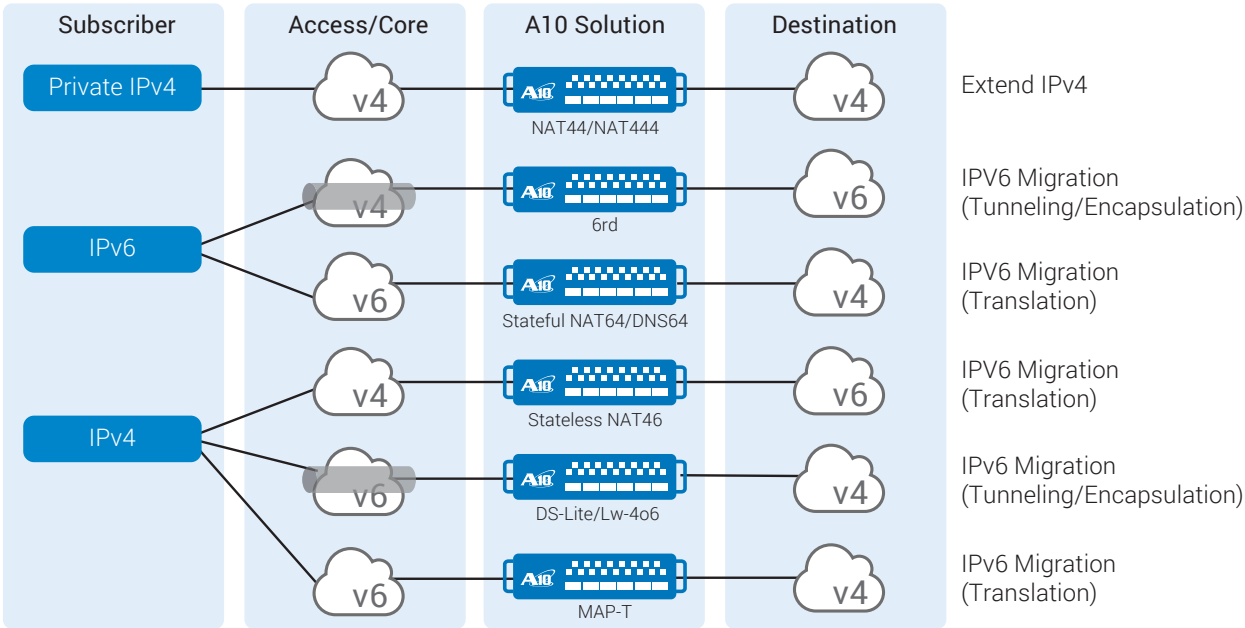

Figure 4: IPv4 extension and IPv6 migration options

Payload inspection, protocol-aware gateways and IPv4 to IPv6 transition techniques strain CPU and memory resources on traditional router products, which are not cost-effective appliances to deliver high performance and scalability. A10's ACOS platform leverages a high-speed Shared Memory Architecture and Flexible Traffic Accelerator (FTA) technology to efficiently utilize multi-core processors and hardware accelerated network functions to efficiently process network traffic.

As a result, A10 Thunder CGN appliances are significantly more efficient, consumes dramatically less power and less cooling when compared to traditional IP router-based CGN solutions, all which result in unmatched price/performance.

The Big Savings

The two clearest advantages of the A10 Thunder CGN appliances are the industry-leading performance and session scalability. Figure 5 compares the two attributes against CGNAT service delivered by a modern and powerful IP router. Using an IP router to deliver a CGN service is a very common practice because routers are readily available in service provider networks.

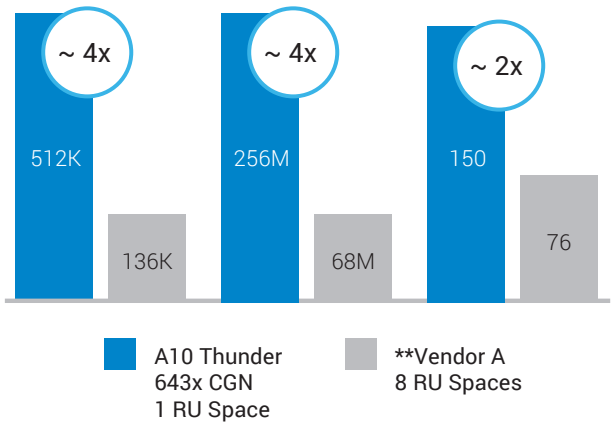

Figure 5: Performance and session scalability comparisons

Despite its much smaller footprint when compared to the IP router, the A10 Thunder CGN delivers much higher performance. However, the real big saving comes from the scalability to support the subscriber IP flows or the concurrent sessions as it is technically referred to – up to 256 million versus 68 million with an IP router.

Let's assume that each home subscriber consumes 500 sessions from one computer during peak hours from running an iTunes application (250 sessions), a Google Image Search (50 sessions), Amazon (90 sessions), YouTube video (90 sessions) or just one file download with BitTorrent, which can easily consume 700 sessions. Dividing 256 million by 500 session, a single A10 Thunder CGN can effectively support 512,000 home subscribers simultaneously, while the IP router tops out at 136,000 suubscribers.

Putting these numbers into a TCO calculation that takes into account all of the costs associated throughout the life of an asset, A10 Thunder CGN saves about 60% in four years and 80% in eight years. This is the most compelling reason to choose a purpose-built CGN solution—because it makes a big difference to the bottom line.

Figure 6: TCO savings with A10 Thunder CGN

Integrated DDoS Protection

A10 Thunder CGN appliances also come standard with integrated Distributed Denial of Service (DDoS) protection. This integrated DDoS feature provides specialized protection for CGN devices with public facing services because it eliminates large traffic volumes containing multi-vector attacks.

In addition, A10 also offers a specialized A10 Thunder SPE appliances, which are customized to support hardware-assisted Security and Policy Engine (SPE) for high-speed enforcements of security policies. Altogether, these software and hardware capability ensure maximum uptime and frees up network resources to process subscriber traffic, as shown in Figure 7.

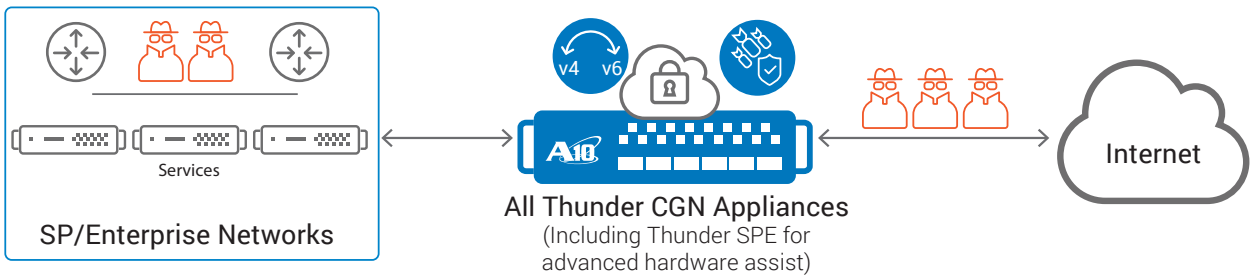

Figure 7: Integrated DDoS protection with A10 Thunder CGN and Thunder SPE

Ease of Use and Management

Thunder CGN also offers comprehensive management options for operational simplicity and reduced management cost. This includes the choice of an easy-to-use, intuitive Graphical User Interface (GUI) and a Command Line Interface (CLI) similar to the industry standard. Extensive SNMP MIBs support, Netflow, Sflow and a variety of built-in logging capabilities are also supported.

A10's software-based ACOS architecture provides flexibility and supports A10 Networks aXAPI® REST-based API enabling remote interaction from third-party applications to control the appliance. A10's ACOS programmability and Application Programming Interface approach enables A10 Thunder CGN products to integrate with Software Defined Networking (SDN) and Network Functions Virtualization (NFV) fabrics and cloud orchestration appliances like OpenStack, dynamically delivering network and security services.

Summary – A10 Delivers Performance, Scalability and Lower TCO for CGNAT and IPv6 Transitions

Because network addressing and IPv6 transition architectures can vary greatly across and within an organization, service providers need a solution that provide the broadest support for standards-based address and protocol translations. A10 Thunder CGN solution allows service providers to extend the service life of their current IPv4 infrastructure, save cost and gain time to plan their IPv6 transition strategy. It also provides many advanced features with the all-inclusive licensing model and broad choice of Thunder CGN appliances to meet the unique requirements of different networks.

Last but not least, transitioning from IPv4 to IPv6 is a long process that requires a continued assurance of compatibility along the way because of the interactions between a large number of end-users devices, other network elements and application servers. A succesfull rollout plan is very dependant on a trusted CGN partner. As a CGN specialist, A10 leads the industry with proven deployments and in-depth support experience. With Thunder CGN appliances, efficiency and performance are a given. Regardless of the appliance choice, every A10 Thunder CGN appliance sets a new performance and session scalability benchmark in its class that effecitively reduce the overall TCO.

Next Steps

For more information, please contact your A10 representative and visit: https://www.a10networks.com/products/thunder-cgn.

About A10 Networks

A10 Networks is a leader in application networking, providing a range of high-performance application networking solutions that help organizations ensure that their data center applications and networks remain highly available, accelerated and secure. Founded in 2004, A10 Networks is based in San Jose, California, and serves customers globally with offices worldwide. For more information, visit: www.a10networks.com

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