Cisco Carrier-Grade Services Engine—Delivering on the Future of the Internet

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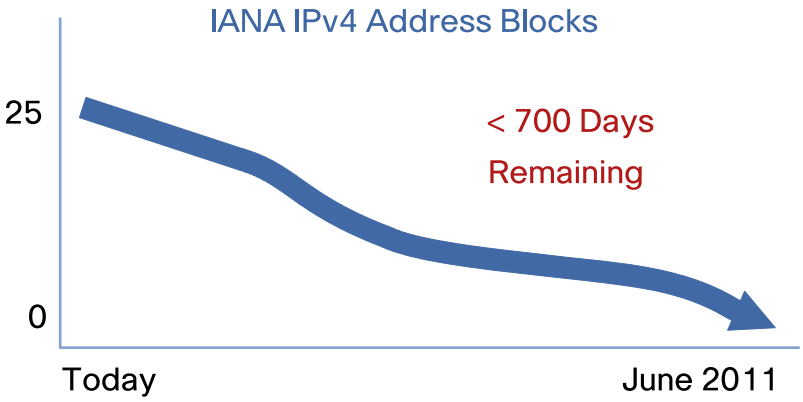
IPv4 Address Run-Out

The current IP address space based on IPv4 is unable to satisfy the potential huge increase in the number of users; the geographical needs of Internet expansion; and the requirements of emerging applications such as Internet-enabled wireless devices, home and industrial appliances, Internet-connected transportation, integrated telephony services, sensor networks such as RFID, smart grids, cloud computing, and gaming. Current projections based on IPv4 consumption rates point to June 2011 as the run-out date.

At the same time, the number of devices being connected to the Internet is rising exponentially, driven by the proliferation of video, mobile, and cloud computing applications. This number will soon exceed the address capacity of IPv4, even after factoring in the use of Network Address Translation (NAT) within homes. At this point, growth of businesses dependent on the Internet is likely to be constrained if no action is taken. Thus, the greater Internet community of service providers, vendors, and customers must address the IPv4 run-out problem now.

Figure 1. Free IPv4 Address Blocks

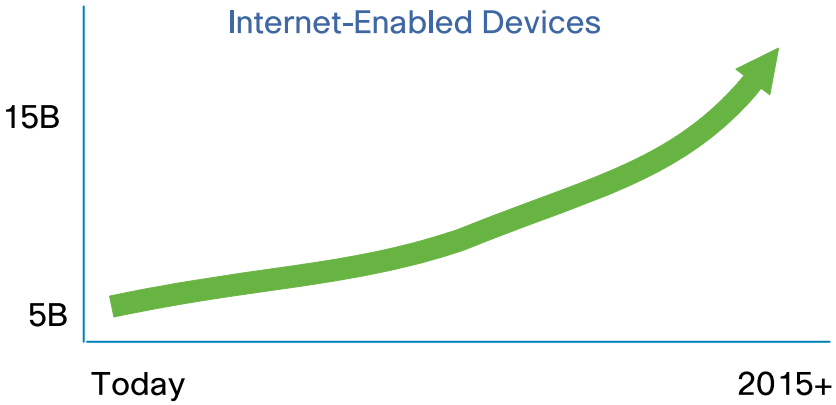


Source: Geoff Huston, http://www.potaroo.net/tools/ipv4/index.html

Carrier-Grade IPv6 Solution

Cisco is leading the journey to address IPv4 run-out with the innovative Cisco® Carrier-Grade IPv6 (CGv6) Solution. Cisco CGv6 adopts a multi-tiered approach to preserve, prepare, and prosper during this migration. With “preserve”, service providers can prolong the life of their IPv4 addresses. With “prepare”, service providers introduce IPv6 in the IPv4 infrastructure for them to coexist while continuing to grow. With “prosper”, service providers eventually move to a mostly IPv6 network, opening up new revenue-yielding service opportunities. The technologies of translation, tunneling, and encapsulation underlie the Cisco CGv6 multi-tiered approach, and these are delivered using new and existing offerings such as the Cisco Carrier-Grade Services Engine (CGSE). To aid service providers on their journey, Cisco offers Services as a part of the CGv6 portfolio. With this comprehensive solution set, customers are assured of an orderly and gradual transition toward IPv6.

Figure 2. Number of Internet Enabled Devices

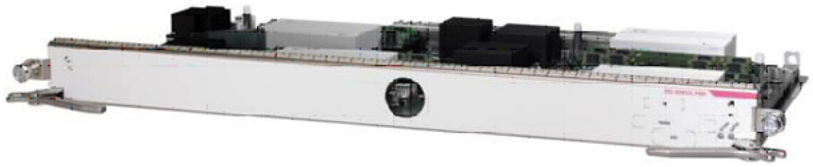


Source: Cisco VNI / Intel Embedded Internet Projections

Cisco Carrier-Grade Services Engine

The Cisco CGSE is an integrated multi-CPU service module offering carrier-class performance and scale in support of CGv6 specific applications and services. The CGSE is a single-slot module supported on all models of Cisco's proven high-end carrier-class routing system: CRS-1. CGv6, running on one or more CGSE modules inside a CRS-1, can scale to tens of millions of IP address translations with tens of gigabits of performance to address IPv4 run-out and enable IPv6 transition. Several modules can be populated within a chassis for a high-performance solution that is deployable at places in the network where maximum CGv6 coverage can be obtained. The CGSE supports a highly available architecture with line rate accounting and logging of translation information. The Cisco IOS® XR Software on the platform offers a flexible means to divert select packets through the CGSE, while enabling global IPv4 and IPv6 packets to traverse the CRS-1 forwarding infrastructure as usual.

Figure 3. Cisco Carrier-Grade Services Engine (CGSE) for CRS-1



Powerful Performance

It is essential that the CGSE housed inside a CRS-1 offers carrier-class performance for CGv6 services. To meet this requirement, the CGSE offers:

- 1+ million connections setup per second for stateful NAT44
- Real-time off-box logging of NAT44 translation state using NetFlow 9
- Line-rate forwarding for IPv4 and IPv6
- Ability to add multiple CGSE modules in a chassis, increasing performance significantly

The CGSE is positioned in the network supporting a large number of IP hosts connecting to the Internet. End-user experience must not suffer for this large set of users. The powerful performance of CGSE as outlined above helps ensure that users continue to be provided optimal experience for all of their services.

Massive Scalability

As an increasing multitude of subscribers with their numerous applications traverse the network, CGv6 must be able to support this growth. The CGSE running CGv6 offers unparalleled scalability in support of IPv4 run-out and IPv6 transition:

- Up to 20 million stateful NAT44 translations per CGSE module.
- Support for **tens to hundreds of thousands** of private IPv4 subscribers accessing the public IPv4 Internet
- Multiple CGSE modules per chassis, which increase scale tremendously

This is important because CGv6 will be positioned in the network supporting a large number of IP hosts connecting to the Internet.

Integrated Services

The CGSE module has been designed for the proven high-end routing platform of the CRS-1. It is supported on all the form factors of the CRS-1, including the 4-slot, 8-slot, 16-slot, and multichassis versions. This breadth allows providers to scale CGv6 to their appropriate needs. Also, CGv6 is integrated with the routing intelligence of the CRS-1, providing operational efficiencies of a single system. Because the CRS-1 platform supports Secure Domain Routing (SDR), providers have the flexibility to integrate CGv6 on a virtualized network infrastructure.

Figure 4. Core Routing Cisco CRS-1

Cisco CGv6 on the CRS-1

The following services constitute CGv6 on the CRS-1:

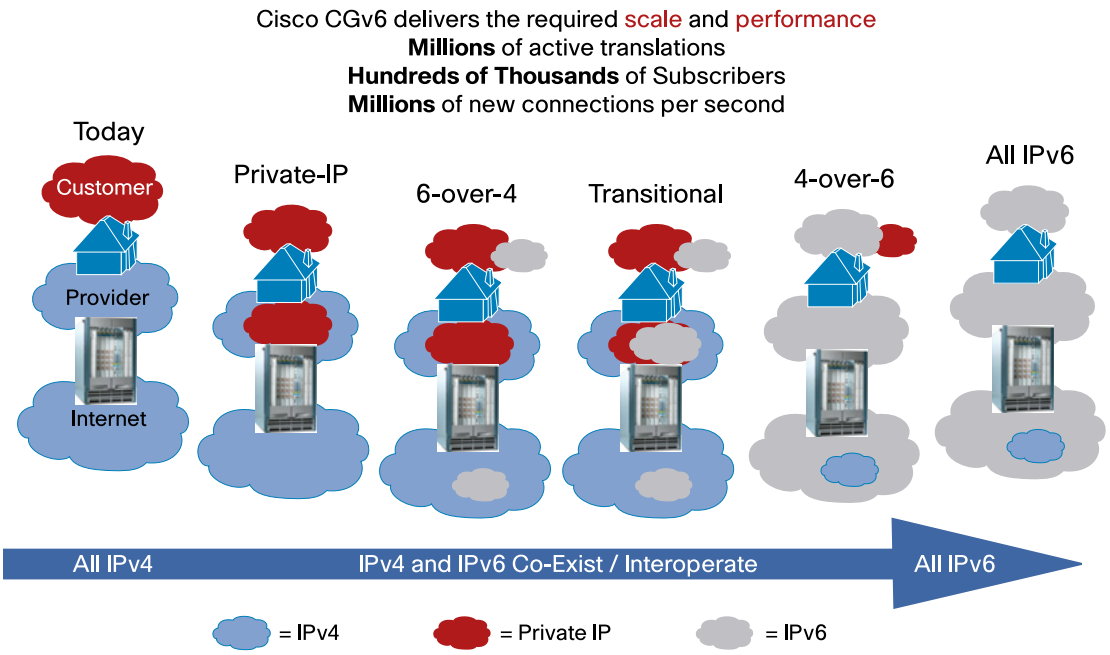
- Full IPv4 and IPv6 routing and forwarding on the CRS-1 platform
- Service provider-class NAT44 to address IPv4 run-out based on existing IETF NAT behaviors described in RFC4787, RFC5382, and RFC5508

Cisco CGv6 solutions being implemented to support IPv6 transition include:

- Stateful and stateless IPv4/IPv6 translation based on IETF BEHAVE specifications
- 6rd Border Relay, described in draft-ietf-softwire-ipv6-6rd
- Dual-Stack Lite Tunnel Concentrator, described in draft-ietf-softwire-dual-stack-lite

The CGv6 solution on the CRS-1 with the CGSE offers service providers a near-term solution to address IPv4 run-out. At the same time, it enables one or more methods to offer a low-risk, cost-effective means to activate IPv6 tunneling and/or translation functions.

Figure 5. Transition Enablers



For More Information

For more information about Cisco CRS-1, visit www.cisco.com/go/crs.

For more information about Cisco service provider solutions, visit www.cisco.com/go/sp.

For more information on the Cisco Carrier-Grade IPv6 Solution, visit www.cisco.com/go/cgv6.

Additionally, you may also contact your local Cisco account representative.

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Printed in USA C02-560497-00 09/09