NRO response to LS 3 – C 19 "Problems and Solutions"

1. Overview

This document responds to ITU IPv6 Group Liaison Statement, LS 3. This Liaison Statement refers to IPv6 Group Contribution C 19, "Problems and Solutions", submitted by the Syrian Arab Republic—hereafter the "C 19 paper".

The five Regional Internet Registries who form the Number Resource Organization (NRO)[1] would like to thank the Chairman of ITU IPv6 Group, Mr Mohammed Al Khamis, for the opportunity to share their views on the C 19 paper with the members of the group.

The C 19 paper suggests that "…historical imbalances [in IPv4] are not being corrected" in IPv6 allocation methods. However, it must be noted that the early large IPv4 allocations were a phenomenon that predated the creation of the Regional Internet Registry (RIR) system of Internet number resource distribution, and there is no evidence that these kinds of practices are being repeated in the IPv6 era. Below you will find further elaboration of the views on the C 19 paper from the five RIRs who together form the NRO.

2. Analysis of the C 19 paper

The C 19 paper states:

> *"14. But those who come later, in particular ISPs in developing countries—who can be expected to emerge in the future—will have to pay more for IPv6 addresses"* (p. 2).

RIRs do not charge fees for IP addresses. Rather, RIR fee structures are based on the recovery of ongoing operational and maintenance costs (allocating addresses, maintaining a whois database for resource registration, and associated services, such as reverse DNS). RIRs consult with their members regarding the activities RIRs perform, and regarding the appropriate member fees. In fact, historically, in all RIRs, membership fees have trended downward. Any future changes in RIR fees will be decided in consultation with their respective memberships.

The fees charged by RIRs for maintenance of an IPv6 block are very low, and the demonstrated need requirements for an IPv6 allocation are lower than for an IPv4 allocation. The barriers to network operators wishing to obtain IPv6 addresses from an RIR, including operators of small networks in developing countries, are minimal. In addition, networks that are not ISPs can also qualify for IPv6 addresses.

[1] The five RIRs are AfriNIC, APNIC, ARIN, LACNIC, and the RIPE NCC. Four of the RIRs who form the NRO are ITU sector members: AfriNIC, APNIC, ARIN, and the RIPE NCC.

The C 19 paper also states:

> *"15. And they might not even be able to get large blocks. We are told that, at present, there is no need to fear a scarcity of IPv6 addresses. But we are also told that there is every reason to fear excessive growth of routing tables, and that the RIRs have to take measures to ensure that routing tables do not grow too large. So the scarce resource is routing table entries, not IPv6 addresses.*
>
> *16. The early adopters of IPv6, mostly in the developed countries, will get those scarce routing table entries first, and the late-comers, mostly in the developing countries, will once again be locked out, thus reproducing the situation of IPv4"* (p. 2).

There has been steady growth of the routing table over recent years. To date, this rate of growth has not outpaced the ability of router technology to effectively route Internet traffic. RIR IPv6 allocation policies and practices are designed to ensure that routing table growth remains steady and does not eclipse the technology in the foreseeable future. This is done by:

1) Providing networks with larger blocks to grow into (in IPv4, given the smaller number of addresses available, there was more emphasis on immediate need for addresses; in IPv6, there is more scope to allocate for networks' longer term needs)
2) Practising sparse allocation techniques that enable networks to aggregate multiple allocations from RIRs

The steady growth of the routing table under RIR policies and practices will allow router memory capacity to continue to grow at a rate that can accommodate the increasing size of the routing table.

Regarding the statement that "developing countries, will … be locked out, thus reproducing the situation of IPv4", it is important to note that late Internet adopters have not been locked out of IPv4. There are policies in place that ensure that until the IPv4 pool is exhausted at the RIR level, anyone who can demonstrate a need for addresses will receive addresses to meet that need.[2] The continuation of this system for IPv6 distribution means that networks in developing countries will be able to access as many IPv6 addresses as they need.

The C 19 paper states:

> *"18. Indeed, APNIC has provided some Fact Sheets to Correspondence Group 2 (by E-Mail of 31 July 2010) which refer to data that support the above considerations. The fact sheet titled "IPv6 Statistics for United Nations Member States" shows that a few OECD countries (and Brazil) have the larges [sic] share of IPv6 addresses at present. And the fact sheet titled "How to get an initial IPv6 block from your RIR" explicitly confirms the well-known fact that, in general, only Local Internet Registries (typically large*

[2] See section 2, RIR Comparative Policy Overview, http://www.nro.net/documents/rir-comparative-policy-overview-2010-04

Internet Service providers-ISPs) or holders of an IPv4 address block can easily acquire an IPv6 address block" (pp. 2-3).

Addresses are distributed according to a needs-based allocation mechanism. Under this mechanism, networks with more users will tend to qualify for more addresses. In other words, countries with the largest number of Internet users will be the ones most likely to have networks granted the largest number of IPv6 addresses.

It is not only large ISPs that can request IP addresses. As explained in the "How to get an initial IPv6 block from your RIR" fact sheet referred to in C 19:

> "End sites can also receive IPv6 addresses directly from RIRs. An end site is an organization receiving assignments of IP addresses exclusively for use in its operational networks. Examples of end sites include TLD (Top Level Domain) managers, banks, and small-to-medium enterprises."[3]

Organizations do not need to have received IPv4 address space to qualify for IPv6 addresses. RIRs have already delegated IPv6 addresses to account holders that do not hold any IPv4 addresses.

The C 19 paper states:

> *"19. Further, the APNIC fact sheet titled "IPv6 Statistics for United Nations Member States" provides a link to a web site that contains detailed data on IPv4 and IPv6 address allocations. The chart below was prepared from the data contained on that web site. It plots the logarithm of the number of allocated IPv6 addresses versus the logarithm of allocated IPv4 addresses (Brazil and the USA are off the scale). As can be seen, there is a high degree of correlation. That is, the actual data confirms the above considerations: the current holders of IPv4 addresses are the ones who are getting IPv6 addresses. So historical imbalances are not being corrected"* (p. 3).

As stated earlier, addresses are delegated to networks that have demonstrated a need and requested them. At present, since the majority of existing networks have predated IPv6 uptake, clearly, these networks will have existing IPv4 space. As new networks are created, and IPv4 becomes increasingly a legacy protocol, the number of networks built on IPv6 alone will increase.

The statistical analysis shown in the C 19 paper does not, in any way, demonstrate that newcomers are having trouble obtaining IPv6 space. Nor does the graph, which excludes Brazil and the United States of America, and shows aggregate address numbers without the context of Internet users per country, show any trend toward IPv6 imbalances or predict future gaps. Furthermore, there were no reports on this matter to the Correspondence Group 2 (CG 2), established specifically to identify concerns and issues with the current IP address management system after the first meeting of the IPv6 Group.

[3] http://www.apnic.net/__data/assets/pdf_file/0009/23994/how-to-get-initial-ipv6-block.pdf

As has been stated on a number of previous occasions, the historical imbalance of IPv4 distribution is a result of pre-RIR allocation practices. Since the RIRs were created, the policies under which IP addresses have been distributed have been agreed upon by a broad group of Internet stakeholders in an open and transparent fashion. This has resulted in equitable and effective distribution of IP addresses under the RIR system. The practice of allocating addresses based on demonstrated need has proved to be a highly effective strategy for ensuring Internet growth in all countries, both developed and developing.

3. Conclusion

As noted earlier, Correspondence Group 2 of the ITU IPv6 Group was formed to identify concerns and issues with the current IP address management system. During its lifetime, CG 2 received no reports of any problems encountered with current IPv6 or IPv4 allocation mechanisms. The C 19 paper, in addition, does not provide any instances of its assertions that IPv6 addresses are difficult to obtain. The NRO suggests that it is premature for the C 19 paper to therefore suggest solutions to the current IP address distribution model as there have been no concrete reports of problems experienced by networks, whether in developing or developed countries, in obtaining IP addresses.