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Title: Problems and solutions

1. At the 15-16 March 2010 meeting of the IPv6 Group, the defenders of the status quo repeatedly affirmed that there are no problems, everything is working fine, so there is no reason to envisage any alternative to the current IP address assignment mechanisms. Since this was the prevailing view, the Terms of Reference of the second correspondence group do not include consideration of alternatives to the current situation.

2. Syria, on behalf of some Arab states, is of the view that there are problems which cannot be solved under the current mechanisms and that alternatives must be found. Since that topic cannot be considered by the correspondence group, the present contribution is submitted directly to the IPv6 Group itself.

3. The statement of problems is not new. It can be found in ITU-T Study Group 2 TD 14 (PLEN/2) of the 2005-2008 Study Period, in the report of the June 2005 workshop on IPv6[1], and in COM 3 – C 63.

1. Description of problems

4. Contrary to the prevailing view at the 15-16 March meeting, there are problems, and serious ones.

5. We are told that the people who originally designed and who currently operate the Internet are the people best qualified to continue to design it and to operate it. Perhaps, but history does not support that conclusion: surely security, the migration to a larger address space, and the cost of international connectivity could have been handled better.

6. The Internet is not secure, it has proven difficult to migrate its basic addresses to a larger address space, the cost of international connections is too high for developing countries, and the network is regulated by an agent of the US government, ICANN.

Compare this with the other pervasive connectionless packet-switched network: Signaling System 7 (SS7). SS7 is secure, has no addressing issues, has no connection cost issues, is subject to national sovereignty and is used by 4 times more people around the world (and the ratio of SS7 users to

[1] http://www.itu.int/ITU-T/worksem/ipv6/200506/index.html

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Internet users is much higher than 4 to 1 in developing countries, since every mobile user is an SS7 user).

7. The current situation of the Internet is in fact not dissimilar from the situation of telephony prior to liberalization: dominant players have significant marked power, so costs are too high and innovation of the transport and routing protocols is too slow (as opposed to innovation at the application level, which is indeed vibrant, despite the lack of evolution of the basic transport protocols).

8. Indeed, even proponents of the status quo recognize that the migration to IPv6 is not working well, because they call for government actions such as procurement guidelines, government-funded promotion and training, or even outright subsidies.

1.1 Address allocation

9. As can be seen from paragraph 21 of INF-2, prior to liberalization telephony numbering and addressing resources were allocated by the state-owned operators. After liberalization, independent regulators took over this task, in order to ensure transparent, objective and nondiscriminatory access to numbering and addressing resources.

10. What is the situation concerning IP addresses? They are allocated by organizations (the Regional Internet Registries-RIRs) that are controlled by Internet Service Providers. How can this ensure objective and nondiscriminatory access to those addresses?

11. As we heard during the 15-16 March meeting, national ISPs have lobbied their national governments to adopt positions defending the status quo. This is easily understandable, since the ISPs control the allocation of numbering resources that could be requested by their competitors. Imagine what would happen if a government determined its position regarding the allocation of radio frequencies for mobile telephony on the basis of the wishes of existing mobile operators: of course it would oppose the allocation of any new frequencies and any new licenses.

12. That is, the control by existing ISPs of IP addressing resources is not consistent with the competitive environments that developed countries usually favor and try to impose on developing countries.

13. This is not a purely theoretical issue, it has practical consequences. The RIRs allocate addresses on the basis of needs. Consequently, ISPs that already have many customers will get more addresses. Further, at present there are very low fees for the allocation of IPv6 addresses. So those who need addresses now (because they are already in business) will get addresses at low cost.

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.

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. <u>So the scarce resource is routing table entries, not IPv6 addresses</u>.

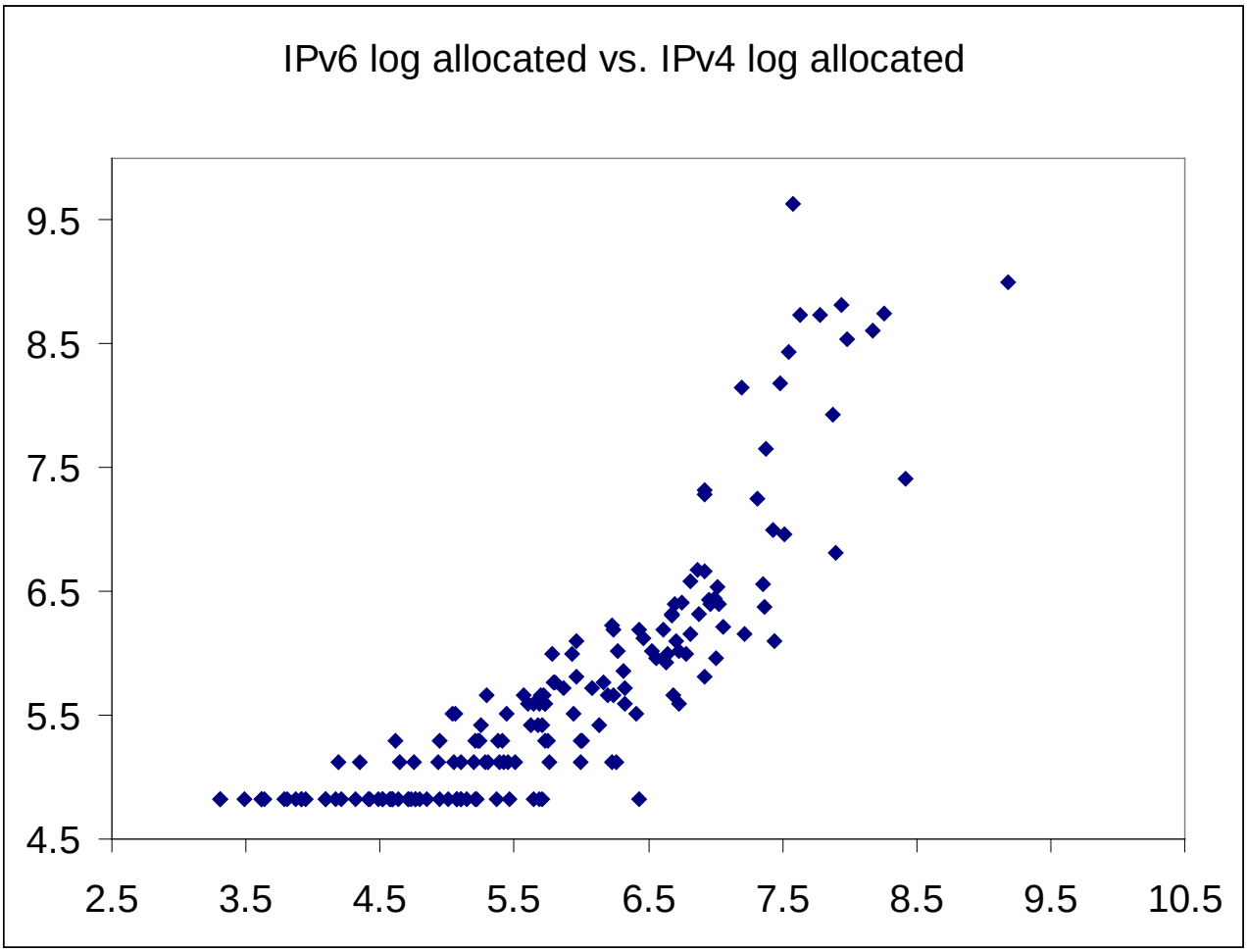
16. The early adopters of IPv6, mostly in the developed countries, will get those scarce routing table entries first, and the late-comers, mostly in the developing countries, will once again be locked out, thus reproducing the situation of IPv4.

17. Some might note that the current IPv6 allocation scheme is not entirely needs-based: large blocks are assigned to any requestor. But only those who already have IPv4 addresses can use IPv6 addresses, because IPv4 and IPv6 cannot directly interwork. So it is still the case that only current players can get useable IPv6 addresses, and so the current scheme will perpetuate the situation of IPv4 allocation.

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 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 Internet Service providers-ISPs) or holders of an IPv4 address block can easily acquire an IPv6 address block.

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[2]. 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.



1.2 Consequences on the cost of International Internet Connectivity

18. During the 15-16 March meeting, we were repeatedly told that IP address allocation has no effect on the costs of international Internet connectivity (IIC). This is not correct. It may be correct that IP address allocation has no *direct* impact on IIC, but it surely has an *indirect*, and important, impact.

19. As stated in paragraph 41 of INF-2, the consequence of the current allocation scheme is that the geography (or topology) of the Internet involves the ISP as the primary subdivision, with frontiers corresponding to interconnections across which global routing information is exchanged.

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[2] See http://resources.potaroo.net/iso3166/

20. That is, the frontiers are set by ISPs, not by national boundaries. But the early ISPs (primarily in developed countries) are the larger ISPs, and they operate internationally.

21. This creates a situation in which a few large players (based in developed countries) have significant market power, because they control the access to many end-users. That is, end-users of large ISPs cannot be reached without the agreement of that ISP.

22. Those large ISPs use their significant market power when negotiating interconnection agreements. We know the results of those agreements: the largest ISPs interconnect without any cross-charges (the so-called "peering agreements") while the smaller ISPs, in particular those in developing countries, have to pay the full costs of renting buying leased lines required to connect to the largest ISPs in the developed countries. See for example COM 3 – C 20 of the 2005-2008 Study Period and see in particular TD 45 (WP 1/3) of the same Study Period.

23. TD 45 contains a paper from two university professors. The abstract of that paper states:

> Is the quality of interconnection between Internet operators affected by their asymmetry? While recent game theoretic literature provides contrasting answers to this question, there is a lack of empirical research. We introduce a novel dataset based on Internet routing policies, and study the interconnection decisions amongst the Internet Service Providers (ISPs) members of the London Internet Exchange Point (LINX). Our results show that interconnection quality degradation can be significantly explained by asymmetry between providers. We also show that Competition Authorities should also focus on the "centrality of an operator", and not only on its market share.

24. The conclusions of that paper further state that asymmetry (that is, the power of large ISPs) does affect bargaining power and peering agreements. The inescapable conclusion is that asymmetry also affects the cost of IIC, and that, as a consequence, developing countries are bearing the full cost of the connection.

25. We are told that the current IIC regime reflects commercial negotiations and market forces. Perhaps, but it reflects the functioning of a market in which big players use their significant market power to their advantage. It does not reflect the functioning of a balanced competitive, open, transparent market.

26. Indeed, those who participate in ITU-T Study Group 3 are well aware of the resistance to collecting and publishing data on traffic volumes, even though one would think that proponents of the free market approach would favor this minimum level of transparency. Such data would prove that the majority of leased and/or bought lines in developing countries are used free of charge by the users in developed countries and this explains the relatively low cost for Internet users in developed countries.

27. In summary, there is every reason to believe that large ISPs in developed countries benefit from their market power to the detriment of small ISPs in developing countries, with the result that the charge for a users in a developing country is very high in comparison with the users in developed countries.

28. As stated above, the current IP address allocation scheme favors large ISPs in developed countries, so it does have an effect on the cost of IIC.

29. Since there was general agreement at the 15-16 March meeting that steps should be taken to lower the cost of IIC for developing countries, there should also be agreement to revisit IP address allocation so as to achieve this goal.

1.3 Consequences on security, spam, etc.

30. During the 15-16 March meeting, we were repeatedly told that IP address allocation has no effect on security, or rather lack of security and the associated plagues such as spam, malware, lack of online protection for children, etc.

31. But the root cause of the lack of security is the same as the root cause of the problems outlined above: if the governance of a critical public resource is left to the private sector, there won't be enough security. Would any government allow airline safety or drug safety to be determined by the industry itself?

32. Why do governments in developed countries allow telecommunications safety to be determined by the industry? Indeed, they don't. The safety (security) of all means of telecommunications other than the Internet is determined by national laws, regulations, and independent regulators. Why should there be an exception for Internet?

33. The question is not theoretical. At present, there are many IP addresses whose owner cannot be determined with any confidence[3]. Surely this situation contributes to spam, etc.

34. Indeed, there is a growing belief that governments should take a greater role in cybersecurity in general, and in Internet security in particular.

1.4 Consequences on migration to IPv6

35. If the current system is perfect, as we are told, then why has it taken so long to migrate to IPv6? IPv6 migration is slow, we are told, because ISPs see the costs of the migration, but don't see any benefits.

36. But that is a consequence of the current allocation scheme: large ISPs have all the IPv4 addresses that they need, so why should they migrate to IPv6? And, if they don't migrate, why should the smaller down-stream ISPs do so?

37. More fundamentally, why isn't IPv6 upwards compatible with IPv4? If it had been, the migration would already have taken place. It is difficult to believe that the difficulties of migration were not foreseen when the IPv6 standard was developed.

1.5 Consequences on national sovereignty

38. As repeatedly stated in the past, in many forums, the current IP address allocation scheme is just one more example of the control by the United States of all Internet naming and addressing resources. At the highest level, IP addresses are controlled by IANA, which is part of ICANN (a US-based organization) and which operates under a contract with the US government.

39. If there were no practical consequences of this arrangement, then surely the US government, and the US Congress, would not resist so vehemently all proposals to introduce a more level playing field, with oversight and governance by other governments.

40. We are told that the ICANN GAC provides adequate government oversight. But GAC is a committee within ICANN, and it has a purely advisory role. IANA has a contract with the US government, not with GAC.

41. Sovereign national control over critical Internet resources cannot be achieved within the current model.

2. Possible solutions

42. The Country Internet Registry (CIR) model presented in TD 3 presents one possible solution to some of the problems outlined above.

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[3] For example, according to the IANA web site at http://www.iana.org/assignments/ipv4-address-space/ipv4-address-space.xml , large blocks are assigned to Digital Equipment Corporation, Bell Northern Research, and other organization that either don't exist any more, or don't actually use the addresses in question. In some cases, there is no easy way to know who is actually using the addresses. In addition, one source has stated that some unallocated addresses are actually being used, see http://marcblanchet.blogspot.com/2010/02/remaining-ipv4-8-prefixes-are-dirty.html

43. During the 15-16 March meeting we were told that implementation of CIR could have disastrous consequence on routing, in particular routing tables.

44. For sure implementation of CIR would change the topology of the network, with more routing taking place at the national level and less through large international ISPs. Consequently, the large international ISPs would lose bargaining power and the cost of IIC for developing countries would drop.

45. However, the CIR model presented in TD 3 would not affect routing tables any differently than the current RIR model, because as stated in section 3 of TD 3, the CIRs would allocate addresses in accordance with the fundamental policies created by the RIRs.

46. That is, a CIR would operate in much the same way that a new RIR (for example an RIR for the Arab region) would operate.

47. We know from past experience that creating new RIRs has not resulted in any problems for routing tables. Why should we think that creating CIRs that operate like RIRs would create problems? It should not, as stated in 3.2.1 and 4.1.1 of TD 3.

48. Indeed, at present, ARIN covers only the USA, Canada, and Caribbean (see 48 of INF-2). Given the relative sizes of those economies, ARIN is in effect a CIR. RIPE-NCC covers Europe. Given the relative size of the European Union within Europe, and the high level of integration of economies within the European Union, RIPE-NCC could also be considered to be primarily a CIR for the European Union.

49. Nobody has ever alleged that the allocation of addresses by ARIN or RIPE-NCC has caused problems. This shows that the CIR model can work, since ARIN and RIPE-NCC are, in practical terms, no different from a CIR.

50. More fundamentally, as stated in 4.1.1 of TD 3:

> As the Internet and IP based services are becoming widely deployed and accepted as public infrastructure and commercial entity of national importance, overseeing the address allocation of this infrastructure at the national level should be given to a national authority for policy control that reflects the sovereignty rights of the user's within those economies. This would be similar in functionality to the liberalized radio spectrum distribution and privatized telecommunications system introducing non monopolistic governing structure of the infrastructure facility.

51. Why should the United States be the only country that enjoys, through its control of IANA, sovereign control of IP addresses?

52. If the CIR model is found to be unworkable, then an alternative to the current situation would be (as already suggested in the past) to replace ICANN/IANA by ITU at the top level. That is, the top-level IP addressing blocks could be assigned to the RIRs by ITU.

53. This would preserve the current allocation mechanism, while ensuring sovereign control by countries other than the United States of America

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