APNIC

Apster

Apster is the quarterly newsletter for APNIC members and the Internet community.

www.apnic.net

Issue 14 June 2005

APNIC - Addressing the challenge of responsible Internet resource distribution in the Asia Pacific region

The emergence of AfriNIC

The African Internet community reached an historic milestone on 8 April 2005, when AfriNIC received full recognition from ICANN, officially becoming the world's fifth Regional Internet Registry.

The resolution to recognise AfriNIC came at the ICANN Board meeting in Mar del Plata, Argentina, following a report by IANA in September noting that AfriNIC had met all criteria for establishing a new RIR.

"This is very rewarding news for Africa and the Internet community at large," said Adiel Akplogan, AfriNIC's CEO. "It is a starting point for more participation by Africa in the global Internet technical cooperation system. It is also a positive step for the continent towards the management of the Internet. Having their own registry is proof that Africans want to look seriously into the evolution of the Internet."

The project to create AfriNIC was started by African network operators and supported by governments of South Africa (which funded the operations center in Pretoria), Mauritius (which hosts the AfriNIC headquarters), and Egypt (which funds AfriNIC's disaster recovery centre).

AfriNIC's structure also reflects the diversity of Africa, with a board elected from the six sub-regions of the continent (Northern, Western, Central, Eastern, Southern, and Indian Ocean).

The successful emergence of this new RIR was supported by the existing RIRs. ARIN, APNIC, LACNIC and the RIPE NCC together provided a financial contribution of $100,000 for the set-up of AfriNIC's operations.

The African region was previously served by three of the other RIRs: APNIC, for Indian Ocean economies; the RIPE NCC, for African economies north of the equator; and ARIN, for those south of the equator.

The economies formerly in the APNIC region which now come under AfriNIC's administration are : Comoros, Madagascar, Mauritius, Mayotte, Reunion, and Seychelles.

Prior to AfriNIC's full emergence, the other RIRs transferred responsibility for those economies to AfriNIC, including all resource records and membership accounts. Under the transitional arrangement, resource requests went to AfriNIC, which acted under the guidance of the respective RIRs.

Now that its emergence is complete, AfriNIC has full responsibility for all the resources and memberships of the region.

The final step in AfriNIC's full emergence came on 27 April, when it signed a joinder to the Number Resource Organization Memorandum of Understanding, thus joining the other RIRs as a full member of the NRO.

It was fitting that this final step took place at the AfriNIC-2 meeting in Maputo, Mozambique, which was well-attended with more than 100 participants representing African LIRs, AfNOG, government officials, ISOC, and the other four RIRs.

During AfriNIC-2, there was also discussion of how future meetings should be scheduled. Although no firm decision was made, it is now expected that AfriNIC and AfNOG will enter an MoU to following the example of APNIC/APRICOT and ARIN/NANOG and conduct joint meetings, to bring together the technical and policy communities.

The AfriNIC-3 public policy meeting will be held in Cairo, Egypt from 22nd-24th November 2005.

Information about AfriNIC is available at:

http://www.afrinic.net

AfriNIC
The Internet Numbers Registry for Africa

P 11

Large IPv4 address space trial for IPv6 deployment

Since 2001, a major trial has progressed in Japan to use large allocations of IPv4 address space to help encourage the deployment and development of IPv6. The Address Working Group of the IPv6 Promotion Council of Japan, here represented by **Kosuke Ito**, explains some of the findings this trial has made regarding the commercial deployment of IPv6.

▲ Kosuke Ito of the IPv6 Promotion Council of Japan, regularly reports the progress of the Large Space Trial.

It is often said that to bring about full deployment of IPv6, there needs to be a killer application. But in reality, there is not yet a sufficient IPv6 environment to bring about such an application. With this in mind, the IPv6 Promotion Council of Japan (IPv6 PC) proposed, and has driven, a special program called “Large space IPv4 trial usage program for future IPv6 deployment”.

This program provides a large IPv4 address allocation to LIRs, simulating the large global address holdings available under IPv6 and allowing the LIRs to experiment, with the hope of creating next generation services and businesses suitable for the coming IPv6 era. The program also has two side objectives, namely revitalising a large, historically-allocated IPv4 address range and identifying potential future issues – both technical and social – that will need to be solved when all devices and terminals are connected globally and directly as part of a “ubiquitous environment”.

The project was first proposed to, and approved by the APNIC community, at APNIC 11 in 2001. Since then, five LIRs have participated in this program, which has helped them start several new types of services, such as a fixed, multiple IP address always-on service; an IP phone solution with VoIP technology; and a ‘city-wide’ wireless LAN connection service in a sightseeing city. Some LIRs have also moved to a very low-price commercial service, which has pushed the deployment in Japan of some of the world’s lowest cost broadband Internet connections.

Many of the LIRs have expressed the view that a large initial address space allocation brought many benefits, allowing them to design a large scale network and address management plan from the beginning which lowers total operation cost, and brings to users the benefits of a useful global address. Moreover, there have been many interesting points observed. For example, in the ‘always-on’ service, P2P application traffic has greatly increased, exceeding HTTP traffic in a very short time. Another example is the multiple IP service, which pushed IP phone subscriptions.

The ultimate aim of this program is to deploy IPv6. When started, the original plan was that the program would complete as LIRs shifted their service to IPv6 and returned their IPv4 addresses by the end of 2005. This was based on IPv6 PC estimates that many LIRs and vendors would start providing IPv6-based services or devices by then. However, in reality, the IPv6-ready service components, devices, and supporting infrastructure such as DNS, are not yet fully mature, so the practice has emerged of starting IPv6 along with IPv4 service in a dual-stack approach. Therefore, it would be hard for participating LIRs to return their IPv4 addresses soon. While many of them have found that IPv6 will be necessary for the expansion of their new services, they require the continuation of this program until a total shift to IPv6 is possible.

Nevertheless, the program has revealed some interesting advantages to IPv6. In particular, one of the LIRs providing IP phone solution services clearly demonstrated that an IPv6-based solution was much cheaper and less time-consuming to start than a similar IPv4-based solution, even if there would be not much difference in user experience. This operational benefit is higher as the service scale gets larger.

On reviewing the findings, IPv6 PC proposed a three-year extension of the trial program. It received community consensus for this proposal during APNIC 19 in Kyoto, 2005. IPv6 PC positioned the extended three-year period as Phase II of this trial program. During Phase II, IPv6 PC will mandate participating LIRs to acknowledge that a full transition to IPv6 will be required so that technical transition experience can be obtained.

IPv6 PC has also developed a web-based IPv6 address management tool for LIRs. This tool was developed because IPv6 address assignment management is different from that in IPv4. The source code of this tool is freely available from IPv6 PC web page.

IPv6 PC has reported regular updates of the trial program at every APNIC Open Policy Meeting since it commenced and detailed reports, including notes of these service developments are available on the APNIC web site. It will continue these updates to contribute to IPv6 deployment experience in the Asia Pacific community by sharing the results obtained, such as LIR experiences, developed tools, and know-how, and will report an update of activity at the next APNIC Open Policy Meeting.

◀ LIRs in the trial found that VoIP services were cheaper and faster to establish in IPv6 networks.

More information about the "Large space IPv4 trial usage program for future IPv6 deployment" is available at:

http://www.v6nic.net

Improving access to IPv6

IPv6 addresses are now easier to obtain from APNIC, following a recent decision by the Executive Council to waive or lower the IPv6 per-address allocation fee for NIRs and “ISP confederation” members.

For standard APNIC members with existing IPv4 allocations, IPv6 address space has always been free (provided the amount received does not exceed the limit for the member’s current membership tier). However, the fee structure for NIRs and ISP confederations is different, involving an annual membership fee based on total addresses allocated plus a one-off per-address fees, whenever additional allocations are made.

In the past, ISP confederations have been entitled to manage multiple distinct pools of IP address space to ease management of addresses within a large network. The EC decision to waive the IPv6 per-address fee for confederation members is based on the understanding and condition that all such members will maintain only a single pool of IPv6 address space, in the same way as do normal APNIC members. This is, of course, much easier with IPv6, due to the HD-ratio utilisation requirement.

In the case of NIRs, the EC has also decided to allow a 90 percent discount on IPv6 per-address fees to NIRs, where allocations are made to existing IPv4 infrastructure. The justification in this case is that per-address fees have already been paid to APNIC for the existing IPv4 infrastructure, and the subsequent allocation of IPv6 space involves a much smaller workload for APNIC hostmaster staff.

These decisions are intended as a progressive step to equalise allocation conditions among APNIC members and to encourage IPv6 deployment in the Asia Pacific region.

Malaysian government commits to IPv6

In March, the Malaysian government declared its goal of having all of its network facilities IPv6 compliant by the year 2008. The commitment, as reported in The Digital Review of Asia Pacific, was announced by Datuk Dr Halim Shafie, Secretary-General of the Ministry of Energy, Water and Communications, and is part of the Malaysian government's broader engagement with IPv6 and the challenges associated with it.

"We have established a National IPv6 Council under the Ministry to provide the vision, mission, and strategic plan for IPv6 implementation in the country," Dr Halim said at the press conference, which was held at the Universiti Sains Malaysia to launch the National Advanced v6 Centre of Excellence (Nav6).

The Malaysian government's commitment to implementing IPv6 is also reflected in the 9th Malaysia Plan, a government programme headed by the Ministry of Science, Technology and Innovation, which will run from 2006 to 2010. As part of the Plan, Malaysian government and industry will work together to develop and promote IPv6, sensor technologies, and broadband technologies.

Dr Halim reported that the government is currently drawing up a budget to promote IPv6 within Malaysia.

Deprecating ip6.int

As discussed in the DNS Operations SIG in Kyoto, Japan at APNIC 19, support for ip6.int as the domain for reverse-mapping of domain names to IPv6 addresses is expected to be removed from the IPv6 standard from 1 September 2005.

When that happens, APNIC will no longer support the creation of new ip6.int reverse DNS registrations for IPv6 delegations. APNIC will maintain existing ip6.int delegations and records for an interim period, but strongly recommends administrators to begin conversion to the ip6.arpa domain immediately, if they have not done so already.

APNIC proposes to withdraw its legacy support for the ip6.int domain on 1 January 2006. At that point, APNIC will cease operating delegated nameservers in the ip6.int domain. Your feedback on the proposed withdrawal date is welcome on the sig-policy or sig-dns mailing lists.

For more background information, please refer to the following Internet Draft:

http://www.ietf.org/internet-drafts/draft-huston-ip6-int-02.txt

ASO Address Council election

An election will be held to fill a vacant seat on the ASO Address Council (AC) during APNIC 20 in Hanoi, Vietnam, on Friday 9 September 2005.

The ASO Address Council (AC) manages the business functions of the ASO, including the development of policy in accordance with the guidelines defined by the ASO MoU. Since 21 October 2004, the role of the Address Council has been performed by the NRO Number Council.

Three individuals are appointed to the Address Council from each of the RIR regions, including two members selected by the respective regional policy forum and one member appointed by the Board of the RIR.

For the first time, APNIC will conduct this election using the secure voting feature of MyAPNIC, as well as by normal paper voting at the meeting. A formal call for nominations will be made on the apnic-announce mailing list.

Further details of nomination and voting eligibility will be published, as they become available, at:

http://www.apnic.net/community/aso/aso_ac.html

index

Application of HD ratio to IPv4

The HD ratio is used to measure address usage efficiency in IPv6. A modified version of the HD ratio has been suggested by some to be potentially useful for IPv4 as well, replacing the current '80 percent rule'. TWNIC's **David Chen** explains the recent survey conducted in Taiwan to investigate this issue.

To increase the understanding of the local Internet sector about IP policy and its policy development processes, Taiwan Network Information Center (TWNIC) holds the TWNIC Open Policy Meeting (OPM) twice each year. The TWNIC OPM is also a platform for local ISPs in Taiwan to discuss or develop Internet resource management policy in Taiwan. TWNIC often uses this occasion to present proposals being developed in the APNIC forums, as well as the details of other policies and information valuable to Local Internet Registries (LIRs) and the public in Taiwan.

APNIC's proposal, "Application of HD ratio to IPv4", (from APNIC 18), was introduced as an informational report during the TWNIC Policy SIG during the third TWNIC OPM, in November 2004. At that meeting, the Policy SIG suggested that TWNIC should conduct a survey to collect information about local ISPs' thoughts toward IP policy development, as well as what kind of practical environment ISPs face nowadays. The survey was intended to be a useful reference for subsequent improvement not only for TWNIC, but also for APNIC or other RIRs. Hence, TWNIC formed a working group to conduct the survey project.

TWNIC has outlined three major purposes intended for the survey project. The first purpose is to introduce the HD ratio to all participants and to explain the current policy of applying the HD ratio in IPv6. The second one is to find out what kind of obstacles ISPs meet when trying to reach 80 percent utilisation in IPv4. The third purpose is for TWNIC to solicit the opinions of ISPs in Taiwan about applying the HD ratio to IPv4.

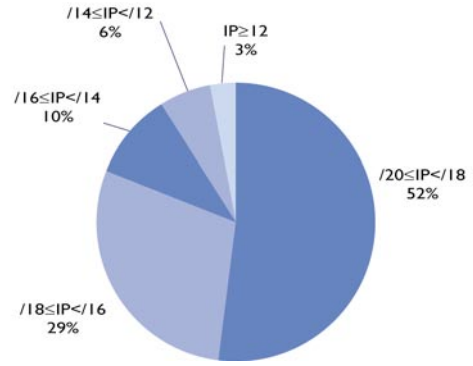
The project ran from 5 to 31 January 2005, during which time TWNIC emailed 67 questionnaires to members of both TWNIC and APNIC in Taiwan. Thirty-five organisations responded via fax or email. The questionnaire comprised four parts as follows:

- The first part was to elaborate the background of the survey and to explain why TWNIC was conducting it.
- The second part was to collect ISP's background information such as contact details, allocated IP blocks from ISPs, and so on.
- The third part was to introduce the concept of the HD ratio to Taiwanese LIRs, including an overview of current utilisation policy, and how to calculate utilisation by HD ratio.
- The fourth part contained the kernel questions of the questionnaire.

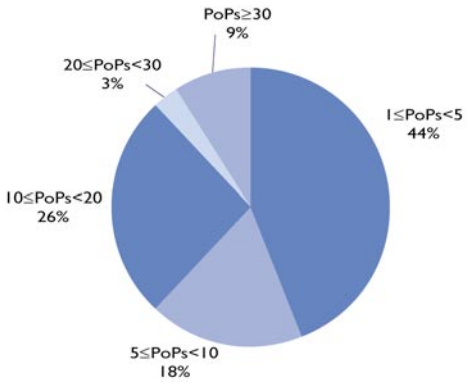
◀ David Chen presents the results of the TWNIC survey at APNIC 19.

After inputting questionnaire data into a database and conducting analysis, we noted with interest that 33 percent of ISPs support the application of the HD ratio to IPv4, while 43 percent of ISPs prefer to keep the 80 percent utilisation as evaluation criteria for requesting subsequent IPv4 allocations in Taiwan. In total, however, more than 50 percent of ISPs in Taiwan would like to change the current IP address utilisation policy.

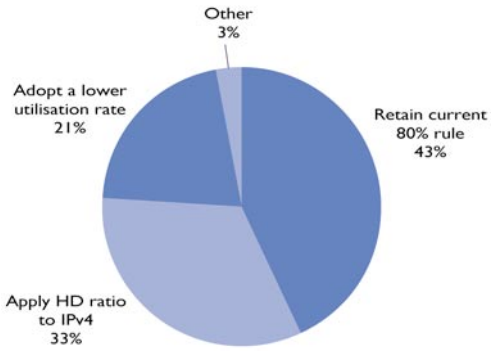
Distribution of ISPs in Taiwan by size of IPv4 address holdings



Distribution of ISPs in Taiwan by number of PoPs

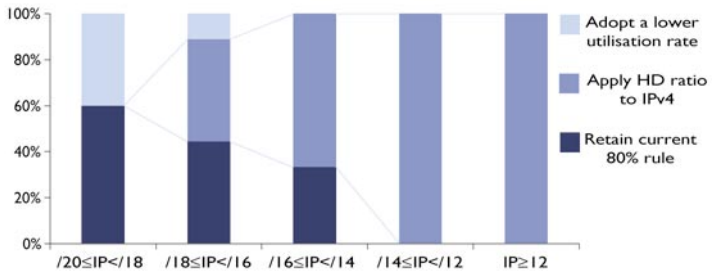


ISP preferences for utilisation policy



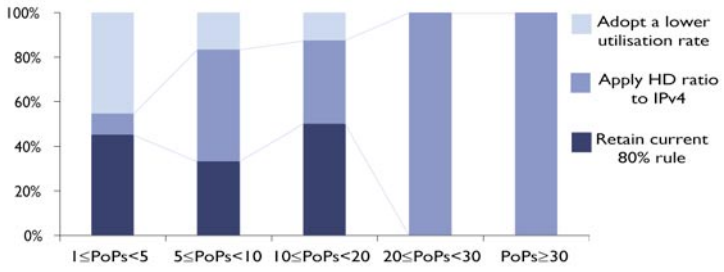
When the data were grouped by size of IPv4 address holding, we found that those who held between /20 and /18 do not prefer the application of the HD ratio to IPv4 at all, but ISPs holding more than /14 strongly agree with the application of the HD ratio to IPv4. In addition, those holding between /14 and /18 show an increasing trend to favour applying the HD ratio.

Preference of ISPs, grouped by size of IPv4 address holding



On the other hand, when responses were grouped by the number of PoPs, we noted that ISPs who had established more than 20 PoPs prefer the application of the HD ratio to IPv4.

Preference of ISPs, grouped by the number of PoPs

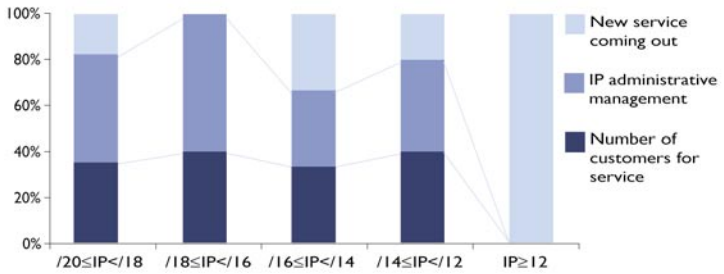


Further analysis of this survey also revealed three major factors affecting the ISPs' ability to reach 80 percent utilisation of their IPv4 addresses, namely:

- the size of customer base (including increases and decreases in the number of customers)
- administrative management, and
- new network services.

Of these three factors, however, new network services had the greatest influence on ISPs which hold more than /12 of IPv4 addresses.

Reasons for difficulty experienced by ISPs, grouped by size of IPv4 holding



P 6

APNIC's LIR survey

Many readers may already be familiar with the proposal to apply a modified version of the IPv6 HD ratio to IPv4 networks, which has been discussed in the Policy SIG during APNIC 18 and 19.

The proposal [prop-020-v001] is based on the assumption that larger LIRs – which create internal administrative and routing structures to help them manage and scale their networks – can find it difficult to achieve the 80 percent usage level which is required to justify a subsequent IPv4 allocation.

Following the recent discussions, the Policy SIG working group tasked the APNIC Secretariat to conduct a survey to help the Internet community evaluate the proposal and analyse the issues related to the 80 percent usage rule.

This survey, entitled "Current practices in managing IPv4 address space", started recently and will continue over the coming months. It is a qualitative survey, which is designed to be carried out face to face, with questions about specific industry experiences.

In particular, it will be used to determine how LIRs manage their IPv4 address space allocations, to identify any difficulties in maintaining efficient hierarchies or achieving 80 percent usage.

Survey sessions are being coordinated with APNIC training and outreach events. APNIC is also very grateful to the NIRs, which are providing assistance by translating the survey and conducting it among their own communities.

So far, APNIC has received responses from participants in Pakistan, India, the Philippines, and Australia.

A full report of the results will be provided at APNIC 20.

Summary of IPv4 HD ratio proposals in other regions

ARIN region

Policy Proposal 2003-10: "Apply the HD Ratio to All Future IPv4 Allocations"

It was proposed that before additional allocations can be made, the HD ratio of all previous allocations should be greater than or equal to 0.966 and the HD ratio of the most recent allocation should be greater than or equal to 0.930.

While no consensus was reached on the proposal, it was agreed that ARIN should look at alternative methods for calculating address usage.

Policy Proposal 2004-2: "Use of HD-Ratio for IPv4 Allocations"

This proposal used the same HD ratio figures as the previous proposal, but suggested that rather than applying the HD ratio to all LIRs, it should be an option for LIRs when requesting additional address space.

There was debate whether there was a need for the proposal or whether reducing the existing 80 percent usage rate would be more appropriate. There were also concerns that the proposal would benefit large LIRs, but not smaller LIRs. There was no consensus to adopt the proposal.

RIPE region

The HD ratio was discussed informally at RIPE 49 in September 2004. In February 2005, a formal proposal was put forward:

Policy proposal: #beta: "IPv4-HD-Ratio"

This proposal suggested adopting an HD ratio of 0.96 for assessing IPv4 address usage. It was to have been presented at RIPE 50 in May, but following another presentation on the HD ratio for IPv6, discussion on the proposal was deferred and returned to the address policy mailing list.

LACNIC region

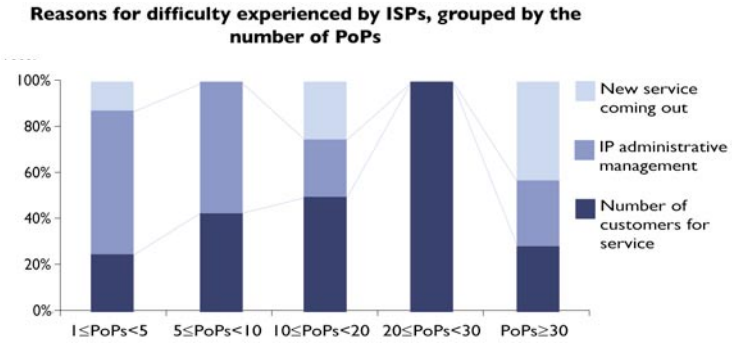
The LACNIC region has not yet proposed a policy for an IPv4 HD ratio. However, there was a presentation on HD ratio proposals from other regions at the LACNIC VI meeting in Montevideo in 2004.

AfriNIC region

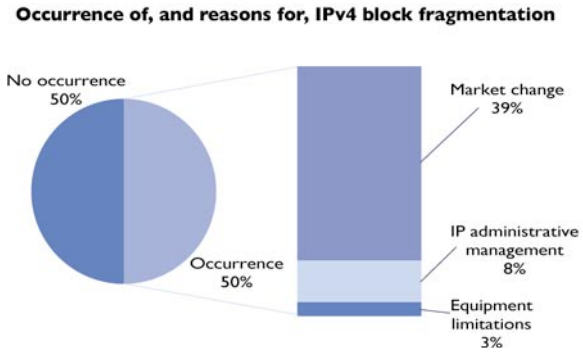
There has been no public discussion on the issue in the AfriNIC region to date.

P 5

Similarly, when we grouped ISPs by the number of PoPs, it appeared that those with more PoPs were more affected by both the number of customers and the new services.



Furthermore, this survey told us how fragmentation of ISPs' IPv4 address space occurs and what factors contribute to this. We found that 50 percent of ISPs have encountered IP block fragmentation problems. For about 39 percent of ISPs, market change is the major reason for the problem. Administrative management is the second major reason, affecting around 8 percent of ISPs. Another three percent of ISPs cited equipment limitation as a cause of fragmentation.



In summary, our significant finding was that an ISP's services, its number of PoPs, and the size of its customer base might all affect the ability of the ISP reaching 80 percent utilisation of IPv4 address space. Considering IPv4 administrative management, an ISP's service types and the size of its customer base were considered the major factors for sub-dividing or allocating IP addresses for specific service.

What reasons might cause IPv4 address space fragmentation during an ISP's operation? Based on our analysis, IPv4 address space fragmentation happens when the market changes for a specific network service. A second major reason is the administrative policies of the ISPs themselves. If ISPs have a clear, IP address sub-division strategy at the start of IP usage, there would be less IP address space fragmentation.

We directly sought ISPs' opinions on utilisation policy and while around 50 percent of ISPs support changes to the utilisation policy, 43 percent of ISPs still wish to retain the 80 percent rule.

Finally, what do we learn from the survey? Do we have any idea who would prefer to apply the HD ratio to IPv4? Yes, according to the above statistics, we found that those who would prefer the HD ratio to be applied to IPv4 utilisation tend to be those with a higher number of IP addresses or established PoPs.

Thus, we conclude that the HD ratio is positive for some big ISPs – and this feeling seems to be similar in other parts of the world. However, this issue is still to gain consensus from the whole Internet community. In the meantime, TWNIC is very pleased to provide this survey result to share our information with the Internet community as a reference.

The original presentation of this survey is available at:

http://www.apnic.net/meetings/19/programme/sigs/policy.html

The geography of Internet addressing

The ITU-T has proposed a new system of country-based IP address allocations which aims to satisfy a natural demand for self-determination by countries. **Paul Wilson** explains how this proposal also stands to realign the Internet's frontiers onto national boundaries, with consequences which are explored here.

Internet geography

As we've often heard, the term Internet originated with the concept of a network of networks, and a vision that many previously distinct computer networks could be linked together and act as one. The success of that early vision is clear – we do indeed see the Internet as a single entity, and we even speak of the Internet's architecture as if there was one designer who laid out a plan and supervised its construction. But despite all appearances, the Internet landscape is indeed made up of many separate networks, run by many independent operators and service providers; and it has a structure that has emerged and evolved over time, more like a geography than an architecture.

If the Internet landscape has a geography, it is a geography based not on physical countries and territories, but on the interconnected networks of which it is comprised. The essential character of the Internet, namely the ability to transmit traffic between any pair of connected points, relies not only on this interconnection of its component networks, but on the consistent operation of those networks according to common standards and policies. Of particular importance is the existence of a single common addressing and routing scheme, which allows new networks to connect into the Internet and immediately share traffic with all others. It must be understood, however, that this essential characteristic is not an assured outcome of the Internet itself; rather it is the result of administrative and operational systems that work specifically to preserve it.

This paper will explore these issues, particularly in light of recent proposals to introduce new mechanisms for IP address management, a prospect which could, over time, substantially alter both the geography of the Internet, and its essential characteristics as a single cohesive network.

Internet nations

To communicate across the Internet, we don't use phone numbers with country-code prefixes, but rather IP numbers (Internet addresses) with network address prefixes. The prefix of an IP address block is similar in function to that of an international phone number, except that the 'nation' it identifies is an Internet network which can be of any size and of any physical extent – global, regional, national, or local. While the phone network currently uses some 220 prefixes, and must distinguish between these when routing phone calls between countries, a typical Internet router currently has some 170,000 allocated address prefixes in its global routing table, and must consider all of these for every individual data packet that is routed between its 'nations'.

Adding new country-code prefixes to the telephone network is an infrequent and highly regulated process, whose engineering impact is limited to the relatively small number of dedicated international switches. In the case of the Internet, new networks are established freely, in an environment of competition which features few specific regulations and no intrinsic alignment with national boundaries. The addition of each new network 'nation' requires an engineering change that must ripple across the fabric of the entire Internet and into every one of the hundreds of thousands of Internet routers that carry a complete global routing table.

The interconnections between Internet networks are extremely dynamic and changes to the global routing tables track the ebb and flow of Internet markets and business relationships, traffic engineering adjustments, and automated network repair mechanisms. While the Internet routing system – which allows this level of dynamism – is highly automated through the use of sophisticated network protocols, it is not a system that can grow indefinitely without bounds.

Transparent borders

It seems that the Internet is like a world with many territories and many borders. This is true, but unlike the borders between countries, the borders between networks on the Internet are easily crossed. Indeed the very nature of the Internet requires that every point on the network is exposed not just to its neighbours, but to every other point. This is intrinsic to the Internet's flexibility and utility as a network, but as we know from our ongoing experience of network abuse (spam, hacking), it also has a downside – namely that the actions of one user can adversely affect many others. In a related way, the actions of an ISP or group of ISPs can and do affect all others on the Internet, either productively or adversely.

Act locally, impact globally

In particular, every new network on the Internet adds at least one IP address prefix to the global routing tables; any ISP can add additional prefixes, in small or large numbers. Since the routers which hold those tables represent the switchboards of ISP networks, they must adjust to changes rapidly and stably in order to continue to exchange traffic efficiently with other networks. A router which is holding a table which is too large for its memory capacity, or which is attempting to process dynamic changes at a rate higher than its processor's capacity, will certainly work more slowly that it should. This alone will generate disruption in immediate neighbouring networks. Worse, an overloaded Internet router may be forced to ignore routing updates or entire routes, effectively disrupting or preventing communications with either a few, many, or all other networks.

The current system for IP address management is concerned, therefore, not only with fair distribution of addresses, but also with maintenance of IP address routability, for without the capability to route an address, the address is useless. There are a number of ways in which the address management system assists and maintains the Internet's routing system. Firstly, IP address distribution is 'provider-based', meaning that addresses are allocated to the discrete IP networks which comprise the Internet, and which are able to maintain the aggregation of those address blocks. In addition, address management policies specifically aim to limit the addition of new routes to levels which are sustainable with current routing technology. They stipulate for instance that except under special circumstances, networks below a certain size cannot receive their own address prefix allocations (instead, such networks are required to join an existing network and receive address space from that provider, coexisting within a single global routing entry). Policies also stipulate that ISPs should limit their fragmentation of address blocks, and limit their announcement of more specific address prefixes to the global routing tables. Such measures are generally effective in ensuring reasonable stability of today's Internet infrastructure, but it is important to understand that such policies are themselves dynamic and can be adapted as necessary to the changing Internet environment.

At an operational level, ISPs typically manage routing table growth by configuring their routers to ignore certain classes of prefixes (such as those for very small networks), and thereby maintain efficient operations. However, in a scenario where the

P 8

number of routes to larger networks increases dramatically, for instance through mismanagement of address space by registries or ISPs, many providers would have to implement far stricter policies. These measures would inevitably result in loss of connectivity between some existing networks, but if implemented widely, they would result in widespread loss of global Internet connectivity, particularly affecting smaller and more remote networks and users (those networks that are unable to employ the latest high capacity router technologies, and who are perhaps less likely to represent commercial priorities for larger providers). If we ever reach a point of routing crisis in the Internet, it will be the smaller and more isolated networks which first experience the impact of selective isolation.

Experiments in geographical address management

In the early days of IP address management, until some time in the early 1990s, it was commonly assumed that the Internet's geography would follow that of the physical world. In some cases, large address blocks were set aside for entire countries, and in some of these cases, organisations were formed within those countries to manage that address space (often these were called NICs or Network Information Centres). Early examples of these were JPNIC in Japan and AUNIC in Australia, and by the mid-nineties, several national NICs were formed.

At the same time, the ongoing growth of the Internet was forcing other changes in our approach to address management. The increasing workload experienced by the InterNIC, the global address registry, combined with the need for more careful address management, prompted a call to regionalise the address management task. By 1993, new Regional Internet address Registries (RIRs) had been formed in Europe and the Asia Pacific. The growth of transnational ISPs meant that many larger players lost interest in national registries, so that by the late nineties few new national NICs were being formed, while some were even disbanded.

Regional Internet address registries

Since their establishment, the RIRs have become the sole mechanism for distribution of IP address space to their users, namely ISPs and network providers, throughout the world. Today, 5 RIRs are in operation: AfriNIC serving the African continent, APNIC for the Asia Pacific, ARIN for North America, LACNIC for Latin America, and RIPE NCC for Europe. All of these operate as independent and neutral non-profit organisations, based on an industry self-regulatory model in which open and transparent, bottom-up processes are used to consider the inputs of all stakeholders in the formulation of address management policies.

National IP address management – the APNIC experience

At the time of APNIC's establishment, in 1993, several National NICs were established or emerging and these were incorporated into the initiative through the confederation or NIR membership structure. The benefits of this structure included service to local ISPs in the local language and timezone, and integration of additional services relevant to the local community. At the same time, several of these existing organisations, most notably JPNIC, supported and contributed greatly to the establishment of APNIC.

Unfortunately, as time went on, the NIR structure of APNIC became problematic in certain respects. Each NIR received its own allocations, which they were able to manage according to local policies, but these policies could not be easily coordinated. This resulted in a situation in which IP address blocks became fragmented, with adverse impacts on ISPs and on the global Internet. After some years of operating in this mode, problems had increased to the extent that APNIC suspended the admission of new NIRs (in 1998).

▲ National participation in IP address management is already well-established in the Asia Pacific region through the NIR model, with six NIRs currently established.

Some years later (since 2002), new APNIC NIRs are being established again, but with certain specific conditions which address the previous problems. First, an NIR is committed to follow regional and global policies, in order to avoid incompatible policies which could conflict with those of other countries or networks. Further, in order to reduce fragmentation of address space, which also has global impact, an NIR does not receive its own block of addresses. The NIR is able to process and approve IP allocations, but those allocations are taken from the APNIC pool rather than from a separate national pool. This 'shared address pool' model of regional address space management was introduced with the consensus of the APNIC community including the NIRs themselves, and is critical to the efficacy of APNIC's NIR system.

What about IPv6?

It is important to note that for the purposes of this discussion, the IPv4 and IPv6 addressing systems behave identically. There is no solution offered by IPv6 to the issue of fragmentation or routing table growth, so it is to be expected that routing tables in an IPv6 Internet would be of a similar size to today's tables. On the other hand, the much larger size of IPv6 address space appears to provide the great danger of an explosion in routing table sizes, particularly if allocation mechanisms are introduced that conflict with today's measures for the control of table sizes.

The ITU proposal for national allocations

The recent ITU proposal that countries should receive and manage separate IPv6 allocations carries a certain risk in this respect. Apart from imposing a potential cost and obligation on every country to establish an agency to manage this resource, certain technical risks would be created which have global implications. The possibility of even a small number of different IP address policy regimes, let alone the potential for some 200 different policy regimes, could certainly produce negative effects not before seen on the Internet. Excessive consumption and subdivision of address space under such policies could result in very large numbers of additional address prefixes within the IPv6 routing tables, which would need to be carried by every ISP on the Internet. Carriage of such routes would impose performance and cost impacts that many ISPs could not afford, while address space which is dropped from routing tables is effectively unreachable by some or all of the Internet, generating an obvious impact by selectively isolating network users from each other.

One response to this problem of excessive fragmentation in the routing space could be to contemplate further national regulatory intervention. A country may need to establish not only a management system for address space, but also support specific shared infrastructure for carriage and management of Internet traffic at the national level (for instance by way of national Internet gateways and aggregation points), as well as inter-provider settlement schemes which have been difficult if not impossible to establish within the Internet context. Another possible outcome is the prospect of a gradual degrading of

the Internet as a single cohesive global network, into one in which specific agreements are made by every pair of networks that wishes to exchange traffic. While such a system works in the scale of the global telephone network with some hundreds of providers, it must be remembered that a full set of bilateral agreements among the tens of thousands network operators would require hundreds of millions of such agreements. Clearly this is not a universal solution, and it is a more likely outcome that smaller network providers will be driven out of the market by a small set of larger multi-national providers.

It is clear that addressing systems lie at the very heart of networks, and that there is a close relationship between the address system, the services that a network can offer, and the nature of the business structures that support the deployment and operation of the network. Placing an inappropriate or badly attuned address system into an existing network model risks not only disruption and burgeoning cost overheads, but ultimately the destruction of the cost value of the network and its very reason for existence. The substantial cost and potential risks of such changes must surely be well justified by the real benefits that are offered.

Conclusion

The structure of today's Internet is a geography of independent networks around the world, with transparent borders allowing traffic to flow freely between any pair of locations. While there are cases of inequality in terms of inter-network arrangements for funding certain network connections, there is an overall equality implied by the ability of all networks, once connected, to exchange traffic as peers.

Many have claimed that the Internet's new paradigms will force a restructure of society, even threaten the nation-state. This is proving far from correct, but there are certainly aspects of the Internet which do not sit well with the traditional view of world geography. This in itself does create challenges, however, in responding to these we must take approaches which recognize the nature of the Internet we have today, and ensure that essential characteristics are preserved. If our approach is wrong, the end result could be a new form of digital divide, in which the erstwhile global uniformity of the Internet is shared only by privileged countries and companies, while others are left in a dramatically poorer situation.

Further Reading

1. For more discussion of the technical aspects of Internet address management and aggregation, see Geoff Huston's paper "IP Addressing Schemes – A Comparison of Geographic and Provider-based IP Address Schemes" at:

   http://www.potaroo.net/ispcol/2004-12

2. The ITU-T proposal on IP address management is contained within Houlin Zhao's paper "ITU and Internet Governance" at:

   http://www.itu.int/ITU-T/tsb-director/itut-wsis

Thanks

Thanks to Geoff Huston for his valuable contributions to this article.

This article has also been published in the online journal CircleID:

http://www.circleid.com

APDIP iGov activities

In 2004, Asia Pacific Development Information Program (APDIP) launched a project to increase regional awareness of Internet governance issues. All material generated from the project will be contributed to the second phase of the World Summit on Information Society (WSIS) and the Working Group on Internet Governance (WGIG). Two major activities in the project have been completed and are summarised below.

IGOVAP mailing list

The ORDIG mailing list was open for five weeks in January and February 2005, attracting 180 participants from 27 economies in the Asia Pacific region. The major topics of debate were IP address allocations, domain name management, and root server management, where it was debated whether the current administration methods or national-based management were more appropriate. Debate on IP addressing issues seemed to be polarised between the technical community, who referred to operational needs for continuing management similar to the current situation, and less technical participants, who believed that IPv4 was running out and leading to unequal address distribution in developing countries.

Areas also discussed (to a lesser extent) were definitions of Internet governance; use of the Internet to preserve and promote culture; connectivity and bandwidth problems for less developed economies; and network security (such as viruses and spam).

Regional Internet governance survey

Following the discussion list activity, APDIP, with the assistance of APNIC, conducted a survey in February and March. The survey, available online in eight languages, attracted over 1200 responses from 37 economies, and represented the opinions of a wide range of participants. Issues surveyed included privacy and data protection, spam, viruses, wireless policies, e-commerce, and Internet access and speed.

APDIP identified twenty-two separate potential Internet governance issues for the survey and compiled approval ratings for various clusters of issues. In the final report, the authors note that:

> *The survey clearly points out a number of eminent problems in Internet governance that require urgent attention. Concerns about virus attacks, online fraud / cyber-crime and spam are very strong, and they are universally shared by all stakeholder groups and countries at all levels of human development. A cluster of additional issues including illegal content, privacy and policies for the wireless Internet have also been identified as priorities for a wide array of countries and stakeholder groups...*

On the subjects of domain name management and IP address allocation, the authors note that while these "are perhaps the most discussed issues in the international debate on Internet governance, the survey points to a high level of satisfaction with the status quo (44% and 40% respectively)." However, despite receiving higher approval ratings than any of the other governance issues surveyed, these two topics still attracted polarised responses from the participants.

- Samantha Dickinson

For more infomation about ORDIG, including a comprehensive project report, refer to:

http://igov.apdip.net/ORDIG.Survey.Report.pdf

Update on the recovery of unused address space

Background

The proposal for APNIC to recover unused historical address space was first put forward in January of 2004, and was approved by consensus at the APNIC 17 meeting in Seoul.

The proposal was aimed at the significant amount of historical address space that has come under the management of APNIC through either the Early Registration Transfer (ERX) project, or from organisations such as AUNIC and the early registrations of APNIC itself. In particular, the proposal focused on historical address blocks that are unrouted and therefore likely to be unused.

In the interests of address conservation, and given the danger that these unused address ranges may be used for illegal or antisocial purposes (such as hacking and spamming), it was proposed that APNIC recover any historical address space which was determined to be unused.

Recovery of unused address space

Unused address space is defined in the policy as historically assigned address space which has not been routed on the Internet at any time since January 1, 1998, and is not in use for any private purpose. At the time of the original proposal it was estimated that around 36% of all address space that has been allocated does not appear in the global routing tables.

A procedure was put in place through which the APNIC Secretariat would identify those ranges not being routed and attempt to make contact with the original registrant. In cases where the registrant responds, the registrant can choose either to return their unused resources to APNIC or to confirm their stewardship of them. In cases where the registrant is uncontactable, the Secretariat will continue attempting to contact them for one year, after which point the unused address range will be reclaimed.

Current activity

Secretariat staff began attempting to make contact with historical address registrants early in 2005, at which point a total of /9 plus /17 unused address blocks had been identified. To date, a total of 1,537 emails have been sent out attempting to notify historical registrants of their unused address space, and of these cases 284 have already been successfully resolved. The Secretariat will continue attempting to make contact with the remaining cases over the coming year.

So far, 25 organisations have voluntarily returned address space to APNIC, adding up to a combined total of /16 plus /18. Of this total, 20 assignments have been returned from historical AUNIC registrations, while one /16 has been returned from an ERX address range. This recovered address space will be returned to the pool of available IPv4 address space in due course.

Further information

For more information on this project, see the "Guide to the recovery of unused address space", at:

http://www.apnic.net/docs/policy/historical-recovery-guide.html

The original proposal, and discussion surrounding it can also be viewed at:

http://www.apnic.net/docs/policy/proposals/prop-017-v001.html

Call for ICANN nominations

The ICANN Nominating Committee is currently seeking individuals suitable for the following roles:

- two seats on the ICANN Board of Directors
- three seats on the At Large Advisory Committee (from the Asia Pacific, Latin American and Caribbean, and African regions)
- one seat on the Council of the Country-Code Names Supporting Organization (ccNSO), and
- two members of the Council of the Generic Names Supporting Organization (GNSO).

Individuals selected by the Nominating Committee will have a unique opportunity to work with accomplished colleagues from around the globe, address intriguing technical coordination problems and related policy development challenges with diverse functional, cultural, and geographic dimensions, and gain valuable insights and experience from working across these boundaries of knowledge, responsibility, and perspective.

Additionally, those selected will gain the satisfaction of making a valuable public service contribution. Placing the broad public interest ahead of any particular interests, they will help ensure the stability and security of the Internet for critically important societal functions.

These voluntary positions are not remunerated, although direct expenses incurred in the course of duty may be reimbursed. These positions may involve significant international travel, including personal presence at periodic ICANN meetings, as well as regular telephone and Internet communications.

Candidates should be women and men with a high level of qualifications and experience with an international outlook including some familiarity with the Internet. They should be prepared to contribute to the collective decision-making process among ICANN's constituencies, supporting organisations, and advisory bodies.

Applications will be handled confidentially and should be received by 12:00 GMT on 15 June 2005 for full consideration. Selections will be made in October with service beginning in December 2005.

Selection criteria, eligibility factors, roles of each position, application procedure, and contacts are posted at:

http://www.icann.org/committees/nom-comm/formalcall-22apr05.htm

Secretariat update

Technical Services Department

Sanjaya, Technical Services Manager

A founding member of the APNIC Executive Council, and a Secretariat staff member for the past four years, Sanjaya has stepped into the role of Technical Services Manager, taking over the position from George Michaelson. This role involves managing APNIC's technical operations, as well as system and network administration, overseeing a team of 11 staff members.

Sanjaya has been Senior Project Manager with APNIC for the past four years, a role that has seen him involved in a wide range of projects across a number of departments within the organisation.

George Michaelson, Senior Technical Officer

After four years as APNIC Technical Manager, coordinating a team of 11 people in two groups, George has returned to his first love: the keyboard!

George will be working on experimental service deployments, testing new systems, inter-departmental support, exploring data mining and statistics, and other special projects. He will also be continuing his liaison work in member meetings and standards bodies such as the IETF.

Chris Lee, System Administrator

Chris Lee joined the APNIC Network/Operations Team at the beginning of May 2005. Chris brings with him a wide range of experience working for organisations including Queensland Rail and the Snowy Mountains Hydro Electric Authority, and has worked with a range of Windows and Linux operating systems, as well as projects related to VoIP. He is currently completing a Bachelor of Information Technology from Central Queensland University. Chris's role at APNIC will be focused on internal customer support, as well as assisting with general IT infrastructure support and projects as required.

APNIC Open Policy Meetings

Fellowships for APNIC 20

Applications for the APNIC 20 fellowship programme are now open. The 20th APNIC Open Policy Meeting will be held in Hanoi, Vietnam from 6 - 9 September 2005.

The fellowship programme is targeted at networking professionals and provides financial aid to assist in meeting the costs of attending APNIC 20. The deadline for applications is 24 June 2005. Anyone interested in applying for a fellowship can find further details at:

http://www.apnic.net/meetings/20/fellows

Venue change announced for APRICOT 2006 & APNIC 21

The APRICOT organising committee has recently announced that APRICOT 2006, which was originally scheduled to be held in Bangalore, India, will now be held in Perth, Australia at the Perth Convention and Exhibition Centre, from 22 February to 3 March 2006. APNIC 21 will be held at the same venue, from 27 February to 3 March.

Training schedule

2005

May

- 31 Sydney, Australia

June

- 13 Bangkok, Thailand
- 14 - 17 Bangkok, Thailand
- 20 Venue TBA, Vietnam
- 22 Vientiane, Laos
- 24 Phnom Penh, Cambodia

July

- 11 - 12 Jakarta, Indonesia (In conjunction with OPM/NICE)
- 16 - 23 Thimphu, Bhutan (In conjunction with SANOG VI)

August

- 9 - 12 Kuala Lumpur, Malaysia
- 15 Brunei Darussalam

September

- 6 - 9 Hanoi, Vietnam (In conjunction with APNIC 20)
- 27 - 29 Shanghai, China

October

- 3 - 4 Ulaanbaatar, Mongolia
- 19 - 21 Hong Kong

November

- TBA Taipei, Taiwan (In conjunction with TWNIC OPM)
- TBA Beijing, China (In conjunction with CNNIC OPM)

December

- 6 - 9 Bangkok, Thailand
- 12 - 14 Singapore

The APNIC training schedule is provisional and subject to change. Please check the website for regular updates at:

www.apnic.net/training

If your organisation is interested in sponsoring APNIC training sessions, please contact us at:

training@apnic.net

Calendar

Fourth Meeting of WGIG
11-15 June 2005
Geneva, Switzerland
www.wgig.org/meetings.html

PACNOG
19-25 June 2005
Nadi, Fiji
www.pacnog.org

ICANN Meeting
11-15 July 2005
Luxembourg City, Luxembourg
www.icann.org/meetings

SANOG VI
16-23 July 2005
Thimphu, Bhutan
www.sanog.org

63rd IETF
31 July - 15 August 2005
Paris, France
www.ietf.org

PacInet 05
22-26 August 2005
Tarawa, Kiribati
www.picisoc.org

APAN 20
23-27 August 2005
Taipei, Taiwan
apan.net/meetings/future.htm

APNIC 20
6-9 September 2005
Hanoi, Vietnam
www.apnic.net/meetings/20

WSIS PrepCom 3
19-30 September 2005
Geneva, Switzerland
www.itu.int/wsis/preparatory2

RIPE 51
8-14 October 2005
Amsterdam, Netherlands
ripe.net/ripe/meetings

NANOG 35
23-25 October 2005
Los Angeles, USA
www.nanog.org/future.html

ARIN XVI
26-28 October 2005
Los Angeles, USA
arin.net/membership/meetings

64th IETF
6-11 November 2005
Vancouver, Canada
www.ietf.org

WSIS - Tunis Phase
16-18 November 2005
Tunis, Tunisia
www.ietf.org

ICANN Meeting
30 November - 4 December 2005
Vancouver, Canada
www.icann.org/meetings

APNIC 21 / APRICOT 2006
22-23 March 2006
Perth, Australia
www.apnic.net/meetings

How to contact APNIC

Street address	Level 1, 33 Park Road, Milton, Brisbane, QLD 4064, Australia
Postal address	PO Box 2131, Milton QLD 4064, Australia
Phone	+61-7-3858-3100
Fax	+61-7-3858-3199
Web site	www.apnic.net
General enquiries	info@apnic.net
Hostmaster (filtered)	hostmaster@apnic.net
Helpdesk	helpdesk@apnic.net
Training	training@apnic.net
Webmaster	webmaster@apnic.net
Apster	apster@apnic.net

▶ The Member Services Helpdesk provides APNIC members and clients with direct access to APNIC Hostmasters.

Helpdesk Hours
9:00 am to 7:00 pm
(UTC + 10 hours)
Monday - Friday

Member Services Helpdesk

helpdesk@apnic.net

www.apnic.net/helpdesk

☎ +61 7 3858 3188

+61 7 3858 3199

APNIC

Communicate with APNIC via MyAPNIC

APNIC members can use MyAPNIC to:

- view APNIC resources held by their organisation
- monitor the amount of address space assigned to customers
- view current and past membership payments
- view current tickets open in the APNIC email ticketing system
- view staff attendance at APNIC training and meetings

For more information on MyAPNIC's features, see:

www.apnic.net/services/myapnic