Addressing IPv4 fragmentation

At the Routing SIG at APNIC 17, **Geoff Huston** led a discussion panel on aggregation with a presentation entitled "Allocation vs announcement - a comparison of RIR IPv4 allocation records with global routing announcements". This article is his commentary on that presentation, intended to provide some more detail and to highlight some of the considerations behind the APNIC process of determining address allocation policies.

The question being posed is, just how effective are address allocation policies? There are many factors that need to be examined in answering such a question, but the one factor examined in the presentation made at APNIC 17 is how well address allocation policies match deployment considerations within the network.

One way to look at this is to look at the differences between allocation and routing advertisement. If allocated address blocks are too large for network deployments, we would expect to see these allocated blocks being broken up into smaller announcements. It is also possible that we would see some of the allocated address space not being advertised immediately, where the large address block would be broken into smaller segments and announced in a piecemeal fashion as advertised route objects.

In this study the record of address allocations, as published by APNIC and the other Regional Internet Registries (RIRs), is compared to the address entries contained in a dump of the Internet's inter-domain routing table.

There is certainly ample evidence that there are a lot of more specific address fragments being announced into the inter-domain routing system. Since January 2003, there have been a total of 4,364 IPv4 allocations made by the RIRs. So far, 3,457 of these allocations have been advertised on the Internet. There are 907 allocations which do not appear to have been advertised yet, which is not too surprising, as there is normally a delay between a network operator receiving an address allocation and the first address announcement to the Internet. Perhaps more surprisingly, the

remaining 3,457 allocations that were announced to the Internet were announced using 10,874 routing entries. That is an average of 3.1 routing entries for each allocation.

Does that mean that we are allocating addresses in blocks that are too large a unit? A more detailed examination reveals that of these 3,457 allocations, two-thirds of them (2,776 allocations) were advertised precisely as per the address allocation. The other one-third of the allocations generated 8,027 routing advertisements, or a ratio of 6.9 advertisements per address allocation. So, it would appear that in most cases the allocation matches the demands of the network, but in one third of the cases we see some fragmentation of the allocation into smaller routing units.

In the majority of cases of fragmentation, the allocation was a /20, or 4,096 addresses, and this allocation was broken down into a number of /24 advertisements (256 addresses).

That's one data point, but it leads to a second question, namely, is this level of fragmentation getting better or worse when compared to older allocations? To answer, we need to look at the entire collection of RIR address allocations and compare them to the routing table as a time series, looking at the data of the original allocation. If things were improving we would see the fragmentation rates getting 'better' over time. But if the mismatch between allocation units and network deployment was getting worse, we would see the fragmentation levels getting higher.

Also in this issue:

18th APNIC Open Policy Meeting
31 August - 3 September 2004   Nadi - FIJI

APNIC Open Policy Meeting
31 August - 3 September 2004   Nadi - FIJI

APNIC members and those with an interest in the development of the Internet in the Asia Pacific are invited to attend the 18th APNIC Open Policy Meeting (APNIC 18). The meeting will be held at Sheraton Fiji Resort, Nadi, Fiji from 31 August to 3 September 2004, and will be the first time that an APNIC meeting has been held in the Pacific Islands. APNIC 18 is hosted by Telecom Fiji and Connect Fiji.

▲ APNIC 18 will be held at Sheraton Fiji Resort, Nadi.

Sponsors

Silver Sponsor

China Network Information Center (CNNIC)

Silver Sponsor

Japan Network Information Center (JPNIC)

Silver Sponsor

Taiwan Network Information Center (TWNIC)

Silver Sponsor

Softbank BB

Meeting host

Telecom Fiji

Connect Fiji

Programme

APNIC 18 will include the APNIC Member Meeting, Special Interest Groups (SIGs), Birds of a Feather sessions (BoFs), APNIC tutorials, hostmaster consultations, and a social event. The full meeting programme is available on the APNIC 18 website.

The APNIC Member Meeting (AMM) will be held on Friday 3 September 2004. The AMM is open to all and APNIC members can attend free of charge.

APNIC training staff will present a number of tutorials as part of APNIC 18, aimed at helping attendees broaden their knowledge of various aspects of the Internet. These half-day sessions will include an Internet resource management essentials course and a tutorial on the Internet Routing Registry (IRR). There will also be a 4-day pre-conference ISP/IXP networking workshop, held in conjunction with PITA.

Information on all tutorials and workshops is available from the APNIC 18 website. Attendees are advised to register in advance.

Policy proposals and presentations

Members and interested parties are invited to submit proposals to make presentations at the Open Policy Meeting sessions. These presentations can be related to policy proposals or can be purely informational.

The SIG Chairs will issue calls for presentations to the SIG mailing lists. Instructions on subscribing to SIG mailing lists can be found on the APNIC website. Presentations from previous meetings are also available on the meeting archive webpage, at:

http://www.apnic.net/meetings/archive/

Fellowship programme

APNIC is offering a limited number of fellowships to allow members of the Internet community in the developing economies of the Asia Pacific region to attend APNIC 18. Details on fellowship packages and eligibility are available on the APNIC 18 website.

Registration

Registration for APNIC 18 will open shortly. Detailed information and a registration form will be available on the APNIC 18 website from early June.

For more information on any aspect of APNIC 18, please see the meeting website:

http://www.apnic.net/meetings/18/

or email:

meetings@apnic.net

Geoff Huston

One way to display this data is to plot the number of advertised fragments as a ratio of the number of allocations on a month-by-month basis. This is shown in the chart below. Here, a value of 0 is a period where no allocations are fragmented. The higher the value, the greater the degree of fragmentation of the original allocation.

The good news is that the number has been declining over the past four years and we are seeing an increasing match between allocation and advertisements. So, we can provide an indication that the RIR allocation function is getting better in terms of matching the allocation unit to the network deployment requirements. There are, relatively, fewer allocations that 'overshoot' the network deployment requirements. Obviously this is an encouraging observation.

Interestingly, there are two 'peaks' in this figure. The first occurred in late 1995; the second in mid-2000. It may be possible to make some guesses as to what is happening. In 1995, there were still allocations being made using the old classfull address structure, but the inter-domain routing system was, by then, fully capable of supporting classless address objects. This peak appears to be largely the outcome of what was the Class B 'problem'. Class B networks, or /16 address blocks, were evidently larger than the network's general requirements, and these larger blocks were divided into small blocks which were then advertised. So, the first peak appears to be evidence of a mismatch of allocation policies to network deployments in 1995. The second peak appears to match the cycle of the Internet boom and bust. By 2000, the number of individual ISPs was probably at a peak. Many ISPs used address pools obtained from their upstream provider, then announced these fragments directly into the inter-domain routing system in accordance with local objectives of resilience through multi-homing, together with considerations of local traffic load balancing. The post-boom gradual consolidation of this industry sector is evidently mirrored in the decreasing level of address fragmentation as observed in the routing system.

It appears that once an initial network address scheme is deployed, the subsequent changes are relatively minor. This is not surprising, as altering the address deployment within a network involves renumbering the network – a highly complex and expensive task.

Perhaps the level of fragmentation is related to the level of expansion within the ISP industry sector, although this is a relatively weak guess.

It also appears that the fit of allocation to advertisement is improving. This is not only a positive feedback message about the outcomes of the address policy process in meeting the technical requirements of the industry, but is also a positive message about the future prospects for the Internet's routing system. At least within one metric – the size of the routing table itself – we are collectively getting better at performing some good housekeeping in inter-domain routing.

From this perspective it is possible to conclude that, in terms of the match of address allocations to the requirements of deployed networks, our address allocation policies appear to have reached a point where they are reasonably well matched to the environment in which we work.

Geoff Huston's original presentation and a transcript and minutes of the session are available from:

http://www.apnic.net/meetings/17/programme/sigs/routing.html

▶ This chart shows the number of advertised allocation fragments as a ratio of the number of allocations, on a monthly basis. The degree of fragmentation is on the scale of 1 (no fragmentation) to 10 (high fragmentation).
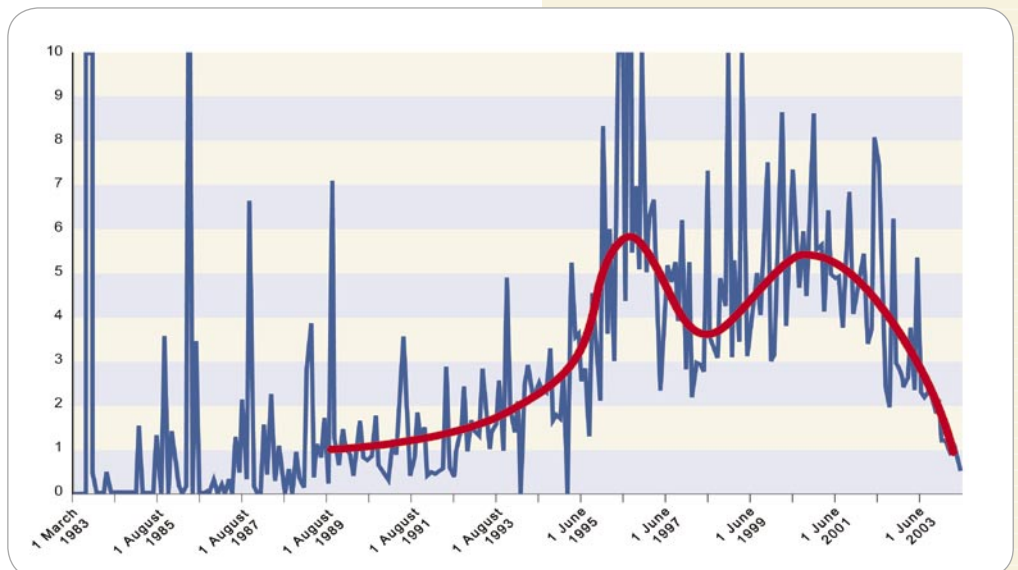
APNIC attends UN ICT Task Force meeting on WSIS

Paul Wilson, APNIC Director General, recently attended the sixth meeting of the UN ICT Task Force, as an invited Internet specialist. The meeting, held last month in New York, was addressed by UN Secretary General Kofi Annan, and attracted the participation of many experts in Internet and ICT related matters. It was a key event in the preparation for the WSIS Phase II Summit, due to be held in Tunisia in late 2005.

The sixth meeting of the UN ICT Task Force was an expert forum for discussing Internet governance issues, prior to the establishment of a special working group on this topic as called for by WSIS Phase I. According to the meeting website, the workshop provided an "opportunity for relevant stakeholders to engage in an open discussion of all aspects of this range of issues".

Paul Wilson

This was not a negotiating meeting, so it was largely devoid of the intense political wrangling that was seen at WSIS sessions in 2003. However, its outputs will affect future negotiations and the issues raised are indicative of what is considered most important for later resolution. Just as importantly, the issues which were not raised should be indicative of the least important areas. Given the ample opportunities and intention that all issues should be raised and considered, it will be harder for those which did not arise in New York to find traction in later debates.

As a meeting of the UN ICT Task Force, the event did have a focus on Task Force matters, and in particular on the role of this group in issues of Internet "governance". The meeting's breakout sessions were convened to consider specific aspects of governance, yet the moderation process tended to focus as much on Task Force actions as on the issues themselves.

Who attended?

In addition to members of the UN ICT Task Force, many invited experts and stakeholder representatives attended, including a good number from the Internet community and administrative organisations. Organisations represented included IETF, ISOC, IAB, RIRs, ICANN, MINC, CENTR, W3C, and companies such as IBM, Sun, and VeriSign. Individual experts and keynote speakers included Internet founders Vint Cerf and Bob Kahn, and several key UN and country officials. Other groups not directly associated with Internet issues, but active during WSIS processes, included ICC, WIPO, WITSA, and numerous UN bodies.

What was the agenda?

In typical UN style, the agenda was coarsely structured, with general sessions incorporating a few presentations, followed by a series of "interventions" (formal statements) by meeting participants on behalf of their countries or organisations.

Day 1 of the meeting was spent on "scene setting" in the morning, followed by breakout sessions on specific governance issues. These were organised under the headings "Internet infrastructure" (defined as physical infrastructure, domain names and IP addresses, standards, root servers, and security), "transactions and content" (defined as including e-commerce, consumer protection, content regulation, speech, and privacy), and "other issues" (those not covered elsewhere). Interestingly, five separate breakout groups were created, with numbers 1 and 2 covering infrastructure (with exactly the same brief), 3 and 4 covering content (likewise), and 5 covering "the rest".

Results from the breakout groups were remarkably consistent considering the diversity of participation. Infrastructure issues raised included international settlements, Internet exchange points, ccTLD management, IP address management, root server issues, and human resource development. Priorities included active facilitation of infrastructure growth and access, maintaining minimal, light-handed regulation, evolution of the ICANN structure, strengthening of a multi-stakeholder approach, and human resource development (especially to assist in infrastructure management, address management, and related issues). The transactions and topics included a wide range of business and consumer issues including intellectual property, e-commerce, signatures, privacy, freedom of expression, user protection, and spam. Group 5, the "catch all" group, covered capacity building, multilingual issues, spam, and the need for policy research and coordination.

The more detailed outcomes of the breakout sessions, along with other results of the meeting, can be found on the Task Force website (http://www.unicttaskforce.org).

It is notable that while ICANN was raised in many discussions, as the subject of both criticism and support, there was no discussion of specific alternatives to it or to the ICANN model. Specific statements tended to agree that "ICANN is working" and while changes may be needed, they should result from continuous evolution rather than other (presumably revolutionary) means.

What was achieved?

Such meetings as this rarely produce specific actions or detailed positions. Rather, the outputs tend to come in the form of consensus on issues that need to be raised and further discussed during future meetings. While this may seem unproductive, it can be critical in identifying the highest priorities for discussion, as well as the lowest (those issues needing little or no consideration in future).

For APNIC, the lack of focus on IP addressing matters was an interesting outcome, as was the lack of discussion of specific replacements for the ICANN model. Can we interpret this as an acceptance of these fundamental models, albeit with a need to continue improvement and evolution? Possibly not, but on the other hand, it makes little sense for those who do propose fundamental changes to play their cards so closely, and reveal nothing of their specific intentions or proposals.

Specific outcomes

If it isn't broken, don't fix it

This cliché of the engineering world was often repeated during the meeting, not only by technical experts themselves, but by other stakeholders and by meeting officials. We also heard statements that "ICANN is working", though generally qualified with the need for continued evolution of the ICANN model.

4

Multi-stakeholder approach

WSIS itself produced very strong words on the need for multi-stakeholder approaches, incorporating the interests of governments, NGOs, civil society, and the private sector. While this general principle is hard to fault, many concerns exist about how it will be implemented.

The New York meeting produced some useful clarity in terms of continuing and improving the current model and strengthening such features as cross-sector information flow, liaison mechanisms, and support for participation by developing countries. The focus seems to have shifted away from either a wholesale relocation of governance functions, or creation of entirely new bodies, as a means to introduce more stakeholders.

Think globally, but act nationally

While the meeting did not produce a definition of Internet governance, it did clarify a distinction between governance issues relating to operation of the Internet itself and those relating to uses of the Internet. It also attempted to delineate issues that are clearly national in scope (or able to be dealt with nationally) from those which require international action or coordination.

The principle of "subsidiarity" was cited, under which problems should be dealt with at a point closest to their source. In the context of an intergovernmental meeting, this of course means that countries should deal with their own problems wherever possible. While this may seem obvious, it has not been spelt out in some previous discussions.

Human resource development (HRD)

While WSIS, in its extremely broad scope, did not distinguish clearly between HRD that relates to the usage of ICTs and that which relates to the creation and proliferation of ICTs, many feel that this is a critical distinction in any discussions about the benefits of ICTs. New York produced some statements regarding the critical nature of HRD pertaining to ICT and particularly Internet infrastructures. This principle has been well known and recognised in the Internet community for many years, as we can see through the training activities of ISOC, the RIRs, and others. Additional international support for such activities will be welcomed by all concerned.

ccTLD and root server issues

It was certainly clear in New York that ccTLD management continues to be seen as the Internet administration issue which is most related to national sovereignty. Once again, strong statements were made to this effect, and questions were raised as to the viability of a system where this sovereignty right is effectively granted by a single country.

While ICANN itself continues to grapple with this issue, an interesting proposal was made that an international treaty approach may be used, guaranteeing each country's right to appear in the root zone of the DNS. Such an instrument, implemented in the simplest workable form, may provide the assurance required, without risking a fundamental disruption of the critical root server system; however, that was by no means an agreed outcome of the meeting.

Regarding root servers, the status and location of root servers was raised, prompting the expected response that over 50 percent of root servers are now located outside of the USA. While valid to a degree, this response does not address the fundamental issue of control, which will no doubt arise again through the WSIS process.

IP addresses

During breakout session 1, on Internet infrastructure, there was a brief discussion of the perceived IP address shortage and detriment caused to the network through the common use of Network Address Translation (NAT). On the first matter, the current rates of IPv4 consumption and supply were clarified, along with the role of IPv6 in addressing both long-term supply issues and a future return to ubiquitous end-to-end connectivity. On the second, it was recognised clearly that NAT, as an operational practice, arises from many factors, but not from any policy requirement. Therefore, HRD, rather than policy, was identified as the appropriate approach to solving such problems, and the discussion produced yet another endorsement of the importance of training to the effective development of Internet infrastructures.

IPv6

IPv6 was discussed a number of times, but not as a key topic of the meeting, nor as a key output. It seems well recognised these days that IPv6 is an available technology whose widespread deployment will be catalysed around the world by many factors. National policy approaches to IPv6 may be helpful in the same way as to any industrial development matter, and may be undertaken at the choice of governments and other agencies. International issues such as IPv6 standards development and address deployment were not specifically raised, so it appears to be assumed that these are not issues of concern, and that they will continue to be well served by existing systems.

Working group composition and secretariat

As a veritable "who's who" of the Internet community, it seems that this meeting should have played a role in identifying participants for the proposed working group on Internet governance. However the composition of the working group is still unknown, as is the exact process by which that composition will be determined. The only specific development so far announced is the establishment of an independent secretariat which will support the group, to be hosted in Geneva by the Swiss Government.

As many other organisations have no doubt done, the RIRs have formally approached the UN Secretary General (in the name of the NRO) offering assistance and requesting participation in the group. This request has been well received, but may only be accepted if sufficient support can be demonstrated.

■ What next?

The next global event on the WSIS calendar appears to be the first PrepCom of the second phase, to be held in Tunis in June 2004. It is expected that the Working Group on Internet Governance will be established before that meeting, but the timeline is not yet known.

Those who are interested in the WSIS processes can find fairly comprehensive documentation on the official website and on numerous independent websites which have been established across the community. In particular, the WSIS-online website hosts discussions involving any interested parties and it has been important so far in attracting contributions and positions from a wider group than can physically attend meetings.

In the interests of the Internet community of the Asia Pacific, APNIC will continue its participation in WSIS, both in its own right and as a member of the NRO. Contributions from APNIC members and the wider community are welcome, as we navigate a path through this new set of challenges.

The WSIS web site is at: http://www.itu.int/wsis/

Internet governance: What are we talking about?

Raúl Echeberría, Executive Director of LACNIC, discusses the ambiguous and imprecise term "Internet governance" and the way it has been used in the WSIS processes.

What is understood by Internet governance?

It has been several years since the discussion of different "Internet governance" models began and this discussion has gained strength during the course of the World Summit on the Information Society (WSIS).

Unfortunately, the WSIS delegates could not have chosen a more inappropriate term. It is impossible to say that all persons involved in the discussion attribute the same meaning to this expression. I personally believe that the opposite is true. There is obviously no Internet government, nor is the Internet "governable" as a whole. There are numerous and extremely diverse aspects to the Internet, some of which are discussed at different levels and by different organisations, while others are determined by local legislation and regulations.

Some of the diverse aspects related to the Internet include e-commerce, intellectual property, e-government, communications, human rights, education, and privacy, among may others. But there is no single organisation or forum where these issues are discussed and channeled. Likewise, there is no single body where all decisions are made and all standards established. The much renowned Internet governance does not exist.

However, the term Internet governance has acquired an existence of its own merely through its constant repetition. For this reason, whether or not many of us believe it an outdated expression, the term is used as a general reference for technical administration and coordination of Internet resources.

In other words, when people speak of Internet governance, they are referring fundamentally to the administration and management of domain names, of Internet addresses (IP numbers and autonomous numbers), the coordination of technical aspects and the definition of the technical parameters necessary for the operation of the domain name system and root servers.

Current situation

With this understanding of the problematic nature of the term Internet governance, we can begin to consider the issues currently under discussion.

Since the beginnings of the Internet, various organisations have assumed active roles in administering and coordinating Internet resources. The fact that the Internet was born as a project depending on the US government resulted in many "Internet system" functions being performed by organisations under government contracts – in many cases funded by US government agencies.

Such is the case, for example, of IANA, the organisation responsible for administering the root of the domain name system and the unallocated Internet number resources (basically IP addresses).

Other organisations, such as the Internet Engineering Task Force (IETF) have operated independently, in an open and participatory manner, from the outset. The IETF is the forum where the standards for Internet architecture and operation are developed. Neither the IETF nor its related organisations (IAB and IESG) depend directly or indirectly on any government.

Root servers are another good example. There are thirteen similar servers, identified with the letters A through M, that constitute the basis (the root) of the domain name system. There is no hierarchy among these thirteen servers – all are at the same level. Ten of the thirteen root servers are located in the United States, with only three controlled by government organisations. Of the three root servers that are not located in the United States, two are in Europe and the other in Japan. The selection of organisations operating the root servers is based on historical reasons, not on geographical diversity. These organisations are not under contract with the US government.

In 1996, a global discussion process began with the aim of reforming the "Internet system". This process culminated in October, 1998, with the creation of ICANN. The idea was to build an international non-profit organisation, with participation and representation of all interest groups related to the Internet. The United States government temporarily transferred to ICANN, via contract, the functions under its control. In theory, when a set of requirements established by the US government is satisfied, these functions will be transferred to ICANN permanently. The current contract between ICANN and the US government expires in 2006 and it is expected that at that time the transition will be finalised and the relevant functions permanently transferred.

Internet governance and the WSIS

During the WSIS preparations, there arose – surprisingly for many – a debate on Internet resource administration models, or Internet governance. Some national governments stated the need for governments to have a greater degree of control in this matter, calling for the functions currently in the hands of ICANN to be transferred to an intergovernmental organisation. Some believe the ITU would be the appropriate choice, while others think some other organisation within the framework of the United Nations would be better (although they do not specify which one, or even if a new body should be formed).

The debate has always focused on the wording of certain paragraphs of the declaration of principles and of the plan of action, but it has never really been made clear what each national government understood by Internet governance, or what is implied by saying that certain tasks would be absorbed by an intergovernmental organisation.

For example, would this imply substituting some other intergovernmental organisation for ICANN? Or is it the intention that only ICANN's current Governmental Advisory Committee (GAC) be replaced by an intergovernmental organisation? As to the functions that would hypothetically be transferred to this intergovernmental organisation, what is their scope? Do they

▶ Raúl Echeberría, Executive Director of LACNIC.

include, for example, the current role of the IETF? Would the new organisation have only policy supervision functions, or would it also have operational functions? It would seem that, even among the countries that promoted the idea of assigning a significant role to an intergovernmental organisation, there are many and quite varied answers to these questions.

The alternatives

The Internet system is much more complex than it sometimes may seem. Frequently the discussion is simplified by mentioning only ICANN, but there are many other organisations involved, such as those we have already mentioned (IETF, IAB, IESG), in addition to Regional Internet Registries (RIRs) and country-code top-level domains (ccTLDs), among others. The current Internet resource administration model may not be perfect, but it is participatory, it is efficient, and it is admirably balanced. The public often demands greater transparency and participation within ICANN's structures, but it is clear that the levels of transparency and participation that have been reached are significantly greater than those of any intergovernmental organisation.

Some national governments have managed to raise this issue, albeit in an imprecise manner, but this was not originally a part of the WSIS agenda.

The idea of an intergovernmental organisation in charge of the various functions discussed has not gained supporters among those more closely related to Internet operation. The most reasonable model seems to be to maintain these participatory organisations in which all stakeholders may express their interests, where the private sector and civil society organisations maintain a major role, and where governments – obviously – also have an appropriate level of participation.

However, it is necessary to attend to some of the claims asserted by these governments, in some cases because they are fair and in others because, although they are not priorities, they have been placed in the spotlight and will remain there until answers are provided.

ICANN needs to become more international, something on which it appears to be working. We need information in more languages, simultaneous translations during meetings, expansion of the number of regional offices, and processes that enable a higher degree of public participation.

The root server issue is an Achilles' heel of the current system. Although the root servers that are located in the US are operated by different organisations and the possibility of conspiracy is absolutely minimal (if not non-existent), and although clones of these servers are now being deployed in many parts of the world (currently 35 copies of different original root servers and rising), it remains difficult to justify that ten of the thirteen original root servers are located in the same country. In the near future, ICANN, working jointly with other system organisations such as the IETF and the IAB among others, will probably have to prove that it is willing to review

the current geographical distribution of these root servers. Obviously this must be done in a responsible manner so that the stability of the network will not be compromised.

Are there any other important elements and factors that could justify transferring these functions to an intergovernmental organisation? If someone believes there are, then it will be necessary for them to specify which things are currently not working and how they could function better within the framework that is being proposed. Today it is not possible to have a clear picture of what these elements might be. It will be the responsibility of national governments to clearly establish their requirements and which changes they want implemented. Governments must also consider whether their needs could be achieved through the current structures.

Conclusions

Internet governance remains a problematic term. But from this discussion of the issues surrounding the use of the term, we can draw the following conclusions.

No one has proposed a system of intergovernmental organisational control of Internet resource administration and structures that would provide a better alternative to the current system.

Within the framework of the current model, both third-world countries and those sectors that usually have the least influence on power structures have had active participation and influence, something that would have hardly been possible in an alternative model, including the one that is apparently being proposed.

There is always much room for improvement, but the correct path appears to be to continue working to improve the current model.

This agenda has been imposed from outside the current system, but is now a part of the environment. Some of the issues that have been set forth will have to be solved sooner than we were planning to deal with them. The existence of the second phase of the WSIS together with its entire process of preparation, which includes the formation of an Internet Governance Working Group for following up on this issue, inevitably implies new schedules and working times.

7

Narantsetseg Bajin:
A digital pioneer who shaped the future

Narantsetseg, Nara to all who knew her, was a rare visionary working at the distant peripheries of the Internet. She bravely embraced the new technologies and made them the centre of her life. It was to be a life cut short but lived inspiringly well.

Nara passed away on March 6, 2004.

To many people outside her country, Nara was not only the representative of the Mongolian Internet but also of Mongolia itself. She was an impressive representation of both.

Nara was equally successful at home. She was awarded the "Best IT Researcher for 2003" by the ICT Stakeholders Group, a recognition which moved her to tears. And on the day she died, the Mongolian Business Women's Association named her the "Best Business Lady".

Nara was in Jakarta, Indonesia, the week before, taking an active part in the meeting of the Panel of Authors of the Digital Review of Asia Pacific. She spoke passionately about the digital inequalities which existed and the importance of not underestimating the commitment required to close the digital divide.

The challenges Nara vividly described never once clouded her vision of what the Internet could deliver: from distance education and expert medical advice to more transparent government and cheaper communication services.

Nara spoke with quiet authority as one of the original movers of the digital revolution in Mongolia. She was the Marketing Director of Datacom, the first Internet services provider in Mongolia, before establishing her own InfoCon Co. Ltd, one of the earliest information technology consulting companies in the country.

Nara took an active part in drawing up Mongolia's Mid-Term Strategy and Plan for the Development of Information and Communication Technologies. She also directed a diverse portfolio of development projects initiated by the International Development Research Centre of Canada, UNDP, Soros Foundation and the World Bank.

Despite all these commitments, which would have discouraged many others, she found time to educate herself. She was working on her PhD even as she ran her company, implemented development projects and travelled widely and regularly to represent Mongolia at international events.

The frantic pace never distracted Nara from what she considered the more important things. On her last morning in Jakarta, even though she had a flight to catch, she found time to assemble a beautifully-arranged platter of fruits to share over breakfast with her fellow authors. Technologies were important to her, but people were even more important.

This tribute to Nara is by the authors and publishers of the Digital Review of Asia Pacific <http://www.digital-review.org> originating from the Pacific Islands, Afghanistan, Australia, Bangladesh, Brunei, Bhutan, Cambodia, Canada, China, Hong Kong, Indonesia, Iran, India, Japan, Laos, South Korea, Sri Lanka, Macau, Maldives, Malaysia, Myanmar, Nepal, New Zealand, Pakistan, Philippines, Singapore, Taiwan, Thailand, Timor-Leste, and Vietnam

The Internet in Mongolia

Mongolia is one of the most geographically isolated areas of the Asia Pacific region, a fact which has presented its Information and Communications Technologies (ICT) industry with many challenges. Over the past decade, however, Mongolia has embraced Internet technology, with more than 40,000 Internet users as of 2002, and has laid the groundwork for its emergence as a modern, online economy.

Mongolia's first entered the online world in 1993, when the state-owned company Datacom set up an email service allowing messages to be sent within the country. In 1994, the newly privatised Datacom, with funding from the International Development Research Centre (IDRC) and the Pan Asia Networking programme, established the nation's first dial-up Internet connection and a network called MagicNet (Mongolian Access to Global Information and Communications). Over the ensuing years, this was upgraded to a satellite connection, providing Mongolian users with a stable link to the rest of the world. In 1996 the first Mongolian webserver was launched, and in April 2001 the Mongolia Internet Exchange (MIX) went into operation.

The challenges faced by the Mongolian industry have included the traditional mindset of much of the population, low incomes, language difficulties, and minimal, or low standard communications infrastructure. Working in the industry's favour, however, has been the high literacy rate (between 95-99%) and a healthy level of government support.

Open community projects have played an important role in ICT growth in Mongolia. OpenMIX, a non-profit exchange point for high speed transfer of local Internet traffic, was launched at the beginning of 2003, and currently links to seven local ISPs via FastEthernet 100M fibre optic. Meanwhile, MagicNet has established projects such as GRID, which provides free CPU-on-demand to organisations engaged in non-profit, computer-intensive activities, and a free email service for qualified educational institutions. Organisations like MagicNet have also focused on the importance of locally designed software, such as MN Messenger, to further encourage Internet use by Mongolian businesses and homes.

Mongolia's fledgling ICT industry now faces challenges regarding regulation and privatisation of the country's communication companies and infrastructure. Given the progress that this small nation has already made, though, all indications are that Mongolia's ICT industry will meet these challenges and continue to grow.

Chris Buckridge

Sources:

- **IDRC website:** http://www.idrc.org.sg
- **Mongolia Internet Exchange:** http://www.mix.mn
- **MagicNet:** http://www.magicnet.mn/english
- **OpenMix:** http://www.openmix.org

Support builds for global IPv6 deployment

The Regional Internet Registries (RIRs), the IPv6 Task Forces and the IPv6 Forum recently announced a joint pledge to support global IPv6 deployment.

Takashi Arano

The IPv6 Task Forces are focused on rapid IPv6 deployment, and see the adoption of IPv6 by industry, governments, schools, and universities as particularly important. The extra address space offered by IPv6 will facilitate deployment of widespread "always-on" Internet services including broadband access for all. In addition, IPv6's built-in encryption will help improve Internet security and is promoted by many government institutions globally.

The co-operation among the RIRs and the IPv6 Task Forces includes key aspects such as:

- Supporting awareness, education and deployment of IPv6;
- Disseminating information on the progress of IPv6 deployment;
- Encouraging dialogue and ensuring the necessary co-operation between all involved parties;
- Benchmarking IPv6 deployment progress;
- Supporting the adoption of Domain Name Service infrastructure necessary for IPv6;
- Encouraging the participation of all those who are interested in the IPv6 policy development process.

This co-operative effort between the RIRs and the IPv6 Task Forces recognises that while IPv4 address space will be available for many years, new users and usages of the Internet have the potential to rapidly increase the use of address space. With the advent of multiple always-on devices, wireless handhelds and 3G mobile handsets, the Internet community needs to prepare for a sharp increase in IP address space utilisation. In order to prevent future operational problems, the global rollout of IPv6 is seen as essential for enabling the development and adoption of new applications and services.

The rollout of IPv6 on this scale requires significant preparation, particularly in terms of training and planning. The RIRs and the IPv6 Task Forces encourage early evaluation by network operators and industry players, in order to promote the necessary technical dialogue and to facilitate widespread adoption. Internet Service Providers (ISPs) can already deploy IPv6 in non-disruptive ways that do not require additional investment, while providing added value to their customers.

Paul Wilson, APNIC Director General, noted that significant advances have been taking place in all the RIR regions with respect to IPv6 allocation and policy. "The RIRs are already working with the IANA and large ISPs to facilitate the delegation of large blocks of IPv6 address space," he stated. "In the Asia Pacific region, a number of countries are taking the lead in terms of IPv6 deployment, and APNIC will continue to offer its support in these areas, and elsewhere, to allow the entire region to benefit from IPv6."

As an IPv6 Forum Board member and an ICANN Address Council member, Takashi Arano of the Asia Pacific IPv6 Task Force steering committee supports this collaboration. "Address management, which the RIRs are in charge of, is one of the crucial components for the commercial deployment of IPv6 and its stable operation," he said. "I hope collaboration between the IPv6 Task Forces and the RIRs will result in the advent of an IPv6-powered 'everything-everywhere-every time' networking world."

Further information is available at

http://www.apnic.net/news/2004/0512.html

• • • • • •

9

About IPv6

IPv6 is a new version of the data networking protocols on which the Internet is based. The Internet Engineering Task Force (IETF) developed the basic specifications during the 1990s. The existing IPv4 protocol has a 32-bit address space providing for a theoretical 2^{32} (approximately 4 billion) unique globally addressable network interfaces. IPv6 has a 128-bit address space that can uniquely address 2^{128} (about 340 sexillion) network interfaces.

LACNIC actively contributes to the development of the Internet and ICTs in the region

AfriNIC holds first Open Policy Meeting

While still a relatively young organisation, LACNIC has shown strong and continuous growth since its inception, incorporating new technologies and employing qualified staff to enhance the level of service it provides. As well as striving for excellence in its core business, LACNIC has emerged as a leader in the promotion of the Internet and ICT development in the region. This vision has led to the creation of several initiatives under the banner of "Programs Oriented to the Community".

■ FRIDA Program - http://programafrida.net

The FRIDA Program (Fondo Regional para la Innovación Digital en América Latina y el Caribe) is made possible through an agreement between LACNIC, ICA, and PanAméricas/ IDRC, along with a significant contribution from the Internet Society (ISOC). The objective of the FRIDA program is to support innovation in Information and Communication Technologies by funding research projects involved in all aspects of this field (social, technological, political, economic, legal, communication, geographic, etc.). LACNIC is responsible for the implementation and administration of this program, which has a total budget of US$480,000.

■ +RAICES Project

The objective of the +Raíces Project is to promote the installation of anycast copies of root servers in the LACNIC service region. To this end, LACNIC has signed an agreement with the ISC (Internet System Consortium) to install anycast copies of the F-root server at seven sites throughout the region. LACNIC will be responsible for the initial installation costs and maintenance over the first two years of operation.

■ FLIP 6 and IPv6 Task Force

LACNIC actively promotes the participation of its members and the community in the deployment of IPv6 and the development of policies regarding IPv6. In March 2004, within the framework of LACNIC VI in Montevideo, the First Latin American IPv6 Forum (FLIP 6) was held, facilitating an exchange of ideas and projects related to IPv6 deployment in the region. Presentations made in this forum are available at:

http://lacnic.net/en/flip-6-pres.html

At the same time, LACNIC is involved in the creation of the Latin America and the Caribbean IPv6 Task Force, providing all the logistical support for its operation. More information on this project is available at:

http://www.lac.ipv6tf.org

For further information on these projects and other LACNIC initiatives, please contact LACNIC Project Management at:

proyectos@lacnic.net

Africa's emerging RIR, AfriNIC, held its first Open Policy Meeting in Dakar, Senegal from 24-25 May. The meeting, which attracted more than 50 attendees, was an opportunity for AfriNIC members (of which there are currently eight) and other interested parties to discuss the policies which will be implemented when the new RIR is officially recognised. These include policies on allocation and assignment of IPv4 and IPv6 address space, database and whois policy, and budget and fee structures.

The meeting marked a significant step in the development of AfriNIC. The proposal for an independent African RIR was first approved by ICANN in 2001. Since that time, AfriNIC staff, with the help of the global Internet community, have been laying the foundations for the new RIR. It is expected that AfriNIC will make its application for official recognition as an RIR in July this year.

An election was held as part of the recent meeting to select the members of the AfriNIC Board of Trustees. This Board is made up of representatives from the six different regions of Africa (North, South, East, West, Central Africa, and the Indian Ocean). The first official act of the newly elected Board was to elect Pierre Dandjinou as its Chair, and Adiel Akplogan as CEO of AfriNIC.

More information on AfriNIC is available at

http://www.afrinic.net

▲AfriNIC Executive Director Adiel Akplogan (front left), Engineer Ernest Byaruhanga (front centre) and Board member Didier Kasole (second row, right) with RIR staff and AfriNIC community members.

Training report

▶ APNIC training held in Hong Kong, April 2004.

New staff member

▶ **Training Department**

Amante Alvaran - Training Officer

The APNIC training department recently welcomed its newest team member, Amante M. Alvaran. Amante comes to APNIC from the Philippines, and has a diverse background that includes working as a network administrator for Globe Telecom, GMCR, and as an account specialist for Meco Technologies. Amante has a degree in electronics and communications engineering and he has also completed a BS degree in aircraft technology from the PATTS College of Aeronautics.

DNS workshop

As the system which translates names to IP addresses, the Domain Name System, or DNS, is a critical part of the Internet infrastructure. Since last year, the APNIC training staff has been developing a 2-day workshop designed to help networking professionals understand DNS concepts, configuration, and operations.

The DNS workshop was first trialed at an APNIC training session in Bangkok, Thailand in March this year. The response from the audience was very encouraging and provided some useful feedback. Since that trial, the workshop has been further enhanced with the addition of new lab exercises. There are already development plans in place to follow up the initial 2-day workshop with a 4-day Advanced DNS workshop that will include DNS security and other advanced topics.

For those interested in taking part in the APNIC DNS workshop, there are a number of opportunities over the coming months.

● Pre-ICANN meeting workshop, Kuala Lumpur, Malaysia, July 16-18, 2004

● SANOG IV pre-conference workshop, Kathmandu, Nepal, July 22-27, 2004

● Hong Kong, Oct 18-19, 2004

● Singapore, Dec 7-8, 2004

For more information on these and other APNIC training sessions, see:

http://www.apnic.net/training

Training Sponsors

Juniper Networks

Nust Institute of Information Technology

University of Santo Tomas

Telstra Wholesale

11

*C*alendar .

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

* To improve services to members, the Hostmaster mailbox is filtered. All email to the Hostmaster mailbox must include a valid account name in the subject line. The account name must be enclosed in brackets or parentheses in the subject field - [XXXXX-YY] or (XXXXX-YY), where XXXXX is based on the member name and YY is the country code. If you are unsure of your exact account name, contact <billing@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

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:

http://www.apnic.net/services/myapnic/

APNIC - Asia Pacific Network Information Centre