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WHITE PAPER ON INTERNET PROTOCOL NUMBER ALLOCATION IN CANADA

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Representing the Internet Protocol Discussion Group of the Canadian Association of Internet Providers (CAIP)
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1. PREAMBLE

An Internet Protocol (IP) Registry consultation group was created by Rayan Zachariessen of UUNet Canada in Toronto in December, 1996. A member of the Canadian Association of Internet Providers, he had been asked by them to gather together a multi-disciplinary group to look at the repatriation of the IP number registry from the InterNIC. The group met twice, once in November 1996 and once in December 1996 via conference call and a listserv was created. The content of this paper comes from the exchange in January 1997 on the listserv and resources available via the Internet.

2. PROBLEM IDENTIFICATION

In May of 1996, the Canadian IP Registry function moved from the University of Toronto to the

InterNIC in the U.S. This meant Canadian Internet Service Providers (ISPs) now had to obtain IP numbers from the InterNIC. No apparent operational problems have been identified because of this change. Numbers are still issued free of charge and the service, from most accounts, seems to be as rapid.

These are, however, several reasons for Canada to explore repartriation. They include:

1. IP registration and domain registration are both functions that have been carried out in Canada by Canadians for a few years. It was decided to give the function back to InterNIC temporarily;
2. it is a matter of principle for Canada to have some level of local control over delegations, not because of politics, but because of awareness; and
3. this is a core business function for ISPs and consumers, and people are nervous about leaving control out of the country and with the InterNIC, who's future behaviour is not predictable.

From the discussion, it appears that the IP Registry has no policy or enforcement function but merely issues numbers from a set of rules based in Requests for Comment (RFC's) and guidelines from The Internet Assigned Numbers Authority (IANA). The organization of IP registries and the numbering system is clearly laid out in RFC 2050. In view of this, the function itself appears to be mainly of clerical importance.

Two important issues, however, flow from this function:

1. The *ad hoc* issuance of numbers means that "Canadian Internet" number management is non-existent and;
2. there is a movement afoot in the U.S. to begin reorganizing the IP domain name and number allocation system and charging for numbers. We currently have no involvement or control over the future cost of issuance of numbers as no body in Canada has been organized and mandated to do this.

Initially, the group had an animated discussion on the registry. There seemed to be a faction which considered Canadian performance of this function to be critical. This appeared to be based mainly on patriotism and the feeling having the registry on Canadian soil would provide. No one was able to concretely say that we could do it better. The other faction pressed for more policy control over the issuance of numbers and the architecture of the Canadian Internet.

The group eventually centered on the issue of the creation of a policy group to look at the Internet in Canada with the IP Registry issue being a collateral issue.

3. ACTIVITY IN THE UNITED STATES

U.S. activity is evidenced in the following short articles submitted to our list:

> Network Solutions, the InterNIC subcontractor that assigns Internet domain names for a fee, has proposed tacking on more fees to the numeric addresses behind those names, addresses that are now free.
>
> Under Network Solutions' plan, a new nonprofit organization called the American Registry for Internet Numbers (ARIN) would replace the government-subsidized InterNIC IP group. North American ISPs would be hit with fees ranging from $2,500 up to $20,000 for blocks of IP numbers that they now receive for free and parcel out to their users....

> Only companies and individuals capable of paying a $1,000 per year in fees will be allowed to participate in forming American Registry's policies. By contrast, any U.S. citizen has the right to file comments with the Federal Communications Commission (FCC) about communications policies.
>
> The American Registry's five-member board of trustees would be initially selected by Network Solutions. Future boards would in their turn be selected by the board that Network Solutions had picked, giving the private company an unprecedented influence over the assignment of increasingly scarce IP numbers. The IP numbering system is reaching its limits and plans are currently being considered to extend it. [Wylie, Margie, "Net Address Fees Proposed." January 10, 1997.]

From the same author on the subject of Domain Names:

> I'll let you in on a little secret about the Internet: The Powers That Be, aren't. The Internet Assigned Numbers Authority (IANA)--the committee that has zillion-dollar companies like PepsiCo standing in line for registrations at the InterNIC, like so many slobs at the DMV--doesn't have the authority of a Jehovah's Witness at the Vatican.
>
> Nobody really cared when the stakes were so low, but with domain names fetching $50,000 price tags and trademark squabbles breaking out all over the Internet, people are starting ask just why the hell the three-person board should control the explosive and potentially lucrative business of domain names.
>
> The IANA has decided to conjure out of thin air some very valuable intellectual property. Starting next year, it proposes to create 50 new top-level domains (TLDs) to help sate some of the .com-envy going around. (TLDs are indicated by the last three letters of an Internet address.) [Wylie, Margie, "Who in the hell does IANA think it is?"]

4. ARIN - AMERICAN REGISTRY OF INTERNET NUMBERS

What exactly is ARIN? We see from the ARIN page in its published organizational plan (http://www.arin.net) that:

> For more than a year, there have been discussions involving IANA, the Internet Engineering Task Force (IETF),the Réseaux IP Européens (RIPE), the Asia/Pacific Regional Registry (APNIC), the National Science Foundation (NSF) and the U.S. Federal Network Council (FNC) concerning a proposal to manage IP number assignments separate and apart from the registration of Internet domain names. The stability of the Internet relies on the careful management of the IP addresses.
>
> Recommendations have also been made that the management of the IP space should be placed, as it is with RIPE and APNIC, under the control of andadministered by those that depend upon and use it - the end users. Those end users include ISPs, corporate entities, universities, and individuals.
>
> Consistent with the RIPE and APNIC models, a non-profit organization has been suggested by representatives of the Internet community as an appropriate organization to manage the IP address space for assigned territories, similar to the RIPE and APNIC regional IP registries.
>
> A proposed, independent, non-profit corporation, The American Registry for Internet Numbers

(ARIN), is described in the proposal.

Similar to other non-profit organizations, funding for ARIN would come from membership dues and fees for registration and maintenance. Membership would be open to anyone with an interest in IP-related activities. Members would be responsible for determining the goals of the registry and how it would best meet those goals.

The fee schedule outlined is similar to that of the RIPE and APNIC models. [www.ripe.net and www.apnic.net] All registration fees described would apply only to those IP number allocations received directly from ARIN. IP address space allocated prior to the incorporation of ARIN is not subject to the proposed fees, and those individuals/entities who have received IP address space prior to the incorporation of ARIN will not be affected by the registration fees.

It is also important to note that almost all Internet users will receive IP addresses from their upstream service provider, rather than directly from ARIN. Those individuals/entities who do not receive address space directly from ARIN will not be charged any registration fees by ARIN....

It is proposed that ARIN be composed of the following :

- Board of Trustees (7-member, 5 voting, 2 non-voting, ex-officios);
- Advisory Council (15-member);
- Members; and
- Operational staff, under the direction of the President of ARIN.

Two main issues came from the discussions - the repatriation of the Internet registry to Canada and the question of the policy and control of IP number assignments in Canada.

5. ANALYSIS

5.1 Repatriation

Given this movement in the U.S., there may be cause for concern that we may soon be subject to change over which we have no control and have had no input. These changes can affect the fundamental nature of the Internet in Canada. However, we are relatively small players. Recent statistics have seen put only three to four per cent of the world Internet in Canada.

From the list discussion, we heard: "It was my understanding that the "value" in having a Canadian IP Registry Service was twofold:

1. To provide IP address space assignments such that they can be aggregated on theborders of the provider's routing domain and at the CA*NET and other Canadian Inter-Provider transport/ exchange networks. This keeps the number of routes and state changes in the inter-domain routing system (between providers) at a lower level than using non aggregated IP addressing. Router resources (processor power and memory) are thus conserved because routers learn and store prefix information representing hundreds of address block rather than learning and storing information about every single block.
2. To provide IP registration services in CANADA, for CANADA. This is of course (in my own personal view) is more patriotic than technical."

However, the patriotic discussion seems to have abated for one in support of the first point made above.

Others commented on the value of having the registry in Canada:

> We certainly need to understand and buy into the "value-added" of a Canadian IP-Registry versus the status quo of using INTERNIC and in the future ARIN. If we can't do IP-Registration faster, better, or most cost efficient why establish an organization to duplicate INTERNIC/ARIN? FASTER, BETTER, CHEAPER.
>
> It is my understanding that currently IP registration services from INTERNIC are free. It's pretty hard to be cheaper than free. I don't deal with INTERNIC directly so I can't comment on how fast they are or if registration can be done better. Can anyone else offer their opinion?

We know from the ARIN plan above that "free" is coming to an end. This concern threaded through the discussion:

> If the ARIN organization fully develops, their proposed fee structure seems to me to be expensive. Would CA-IP-Registry be able to offer equivalent services to Canadian ISPs and Corporations at lesser cost?

In the organizational information on ARIN above, there appears to be a number of mitigating statements on costing. ARIN proposes to be a non-profit organization. It clearly says "it is not intended to for IP address space to be 'sold' under ARIN administration." However, it proposes that "'subscription' fees for registration services be charged to ISP's and other organizations making frequent address block allocations. "The subscription fee model is proposed instead of a fee for per service requests to minimize the cost of accounting and to minimize any advantage for not keeping the database up to date." These costs will range from $2500 US per year for small blocks to $20,000 US per year for "X-large" blocks. All address space will be allocated using RFC 2050 as a guideline. The exact details on the ARIN proposed fee structure can be seen at the ARIN site.

The group also developed a pro/con list on the issue of repatriation:

PRO

- Canadian control in the face of unpredictability of InterNIC
- an opportunity to change the current model
- predictable pricing through non-profit organization (US seems to be privatizing)
- Canadian group would be closer and may have better relationship and influence with Canadian ISP's
- chance to do Canadian-oriented IP Number allocation
- anticipate that no single entity will ever become responsible for the transport of all International Internet traffic to and from Canada, so this is an opportunity to do it ourselves, and
- avoid the flight of Canadian funds south of the border.

CON

- No evidence service will be faster
- the process of re-establishing a Canadian IP Registry will not significantly improve the routing efficiencies of the Canadian or Global Internet at the present time or in the foreseeable future

- deal with two entities instead of just one
- the cost of letting them do it in the USA may be cheaper because of the volumes than it would be in Canada. This is just speculative, since it is free today
- a significant and costly effort to build the database in Canada with ISP friendly Web tools to manipulate them
- we don't seem to have a great deal of involvement from some of the large ISPs in Canada,(iSTAR, Sympatico), nor do we have much involvement from the universities
- the old system worked poorly when it was in Canada and funded by CANARIE. How will a new system be better organized when we have uncertain funding? and
- it took two people full time to run it and growth is significantly higher now. We also had free facilities and space at U of Toronto.

After analysis, it seemed to the members that repatriation answers mainly a patriotic yearning. No concrete, practical issues seemed to predominate. This idea was abandoned.

5.2 Policy/Control

The current Canadian Internet has largely developed in an ad hoc manner. No central body has exercised any control over the technological model, number assignments, aggregation, number conservation or any other issue. This has left the Canadian Internet unprepared for future expansion or evolution in any organized way. No central authority or consultative body has overseen development or produced a plan for the future of the Internet in Canada.

This and other important questions were brought up in the discussion group:

> In this current connectivity model, routing table aggregation/summarization at the national level will have little or no effect on the size of routing tables. Therefore, is the increased efficiency through national aggregation providing enough benefit to continue to summarize address assignments nationally when the Internet in Canada is not organized in a regional/national/international fashion?
>
> Do we anticipate any change in technological/regulatory or market direction that would indicate a return to the regional/national/international connectivity organization structure?
>
> If the answer to both the above questions is No, then it would seem that assigning IP addresses in Canada (to provide for national aggregation) is not a worthwhile cause in itself.
>
> This is an important issue of the viability of a Canadian IP registry. With the current connectivity model in Canada, it is almost impossible to have a national aggregation. A Canadian IP registry will not help to solve this problem unless, of course, the model is changed.
>
> Almost all major Internet exchange carriers in Canada already have a regional/national/international connectivity structure. The thing that has been happening and will be happening more is the interconnection (or peering) between them at major cities in Canada. So we will still have the problem of having multiple providers crossing our national boundaries.

The following was proposed by this author:

> I would like to propose the following statement of consensus with respect to gains in routing efficiencies that can be expected through the efforts of a Canadian IP-Registry.

> Whereas there is no single entity that is responsible for the transport of all International Internet traffic to and from Canada. And that due to the competitive nature of the Internet Marketplace it is anticipated that no single entity will ever become responsible for the transport of all International Internet traffic to and from Canada. The process of re-establishing a Canadian IP Registry will not significantly improve the routing efficiencies of the Canadian or Global Internet at the present time or in the foreseeable future.

This contributor makes the point around which this paper is centred:

> Maybe there are other options too. Canadian interests could also be best served by having the CAIP actively participating in the ARIN meetings/board and representing Canadian interests.
>
> Also since IP registration deals mostly with the two problems of address aggregation and address conservation, may be the solution is to have a Canadian advisory committee on IP routing/connectivity issues and let the US InterNIC be the clerk and assign addresses. They have no power anyway as how routing can be done or whether an assigned address is routable.

Currently, the Canadian Internet community has no control over the evolution of the Canadian Internet. We are small players in a global game which is controlled in the U.S. This is a standard role in all things Canadian which extend beyond our borders. When the U.S. elephant rolls, we usually jump out of the way. There is no indication of any extra-U.S. management plan for IP numbers. This sentiment was echoed by this comment:

> I don't think the InterNIC even care how the industry evolves in Canada or anywhere. They don't make any policy at all. They only apply them. The only think they care are the issues outlined in RFC2050 which, by the way, apply to anyone around the world who wants to connect to the big Internet. They are just managing a scarce resource and could not afford to let anyone waste it.

The policy/control centre for number registration is clearly rooted in IANA. The North American portion of this control now appears now to be destined for delegation to ARIN. The plans have been made and the movement is afoot. And, pardon the parochialism, it does not appear that the mountain will be coming to Mohammed.

ARIN, The American Registry of Internet Numbers, has stated that it will be the issuing authority for "the Americas". This is in line with RFC 2050:

> Regional IRs operate in large geopolitical regions such as continents. Currently there are three regional IRs established; InterNIC serving North America, RIPE NCC serving Europe, and AP-NIC serving the Asian Pacific region. Since this does not cover all areas, regional IRs also serve areas around its core service areas. It is expected that the number of regional IRs will remain relatively small. Service areas will be of continental dimensions.

It does not appear that Canada has a sufficient geographical/Internet size to qualify for a Regional IR. No other subclasses are proposed by this RFC.

6. THE CANADIAN SCENE

The Canadian Internet landscape is made up of a number of players each having varying purposes. None seems to play a lead role in the centralized development of the Internet but all have some influence in it.

CAIP has already been mentioned. It was formed in response to a proposed change in communications arrangements with Bell Canada which would have led to an increase in connexion charges for all ISP's and users.

Information Highway Advisory Council (IHAC): Established by the Minister of Industry, in March 1994 in order to provide advice on major issues in the context of a strategic framework provided by the government,.

Canadian Network for the Advancement of Research, Industry and Education (CANARIE) -CANARIE is a non-profit corporation established on March 5, 1993. It has evolved out of the efforts of more than 200 people from 56 organizations representing Canada's research, university, business and government communities. Their efforts, over a four year period, developed the seven year multi-phase Business Plan which defined a program to improve Canada's overall competitiveness in the Information Age.

CA*Net - CA*net provides an Internet Transit Service in Canada by invitation only.

Major Internet Service Providers - iSTAR, UUNet, Sympatico, Hookup and others.

7. CONCLUSIONS

The group feels that having the IP number registry function on Canadian soil has no relevance on the development of the Canadian Internet. It satisfies mainly patriotic yearnings and is seen as the clerical administration of RFC 2050. However, for the long-term management of the "Canadian" Internet, a body made up of the major players along with a diversity of interested persons is required. This organization would give us credibility and influence as much with the Canadian community as with any American body we might have to deal with, seen currently to be ARIN.

The analysis above makes several clear points:

1. There is no value in repatriating the IP Registry except patriotic.
2. A major issue facing the Canadian Internet is its lack of formal planning or organization especially as relates aggregation and address conservation.
3. The administration of the North American Internet is currently vested in IANA which has proposed to give daily operational responsibilities to a new U.S.-based body called ARIN which would replace the INTERNIC. ARIN is taking a more business-like approach to the management of IP numbers. It plans to begin charging fees.
4. Canada has no national Internet control or organizing entity.
5. The interests of the Canadian population, Internet industry and the future Canadian Internet would be served by the formation of a national body.

8. RECOMMENDATIONS

The members of this group have agreed that the repatriation of the IP Registry to Canada would have no practical purpose. However, the organized issuance of IP Numbers is important to the efficient operation of the Internet in Canada. Currently, we have other initiatives underway in Canada such as the Information Highway project. It is unknown how these projects will interface with the Internet. It is in the industry's best interests to commence planning numbering and networking in order to meet future needs.

The discussions in this group lead us to the following recommendations:

1. Canadian Association of Internet Providers (CAIP) spearhead the organization of a group of representatives of the Internet and the Canadian community to develop aplan for aggregation, efficient routing and IP number allocation in Canada including the reclamation of irregular number space.
2. We are concerned that international protocol may be abrogated if direct contact is made with ARIN by the Internet community. While we know that the government does not regulate the Internet, we recommend that prior to making contact with any U.S. authorities, Industry Canada be petitioned to seek their assistance in liaising with American authorities.
3. This group of Canadian representatives should make contact with ARIN (through Industry Canada if required) and become a member of its Board of Directors or its Advisory Committee.

From this list, this guiding comment:

> Finally, IP address allocation is not just an ISP concern. Businesses and Governments in Canada will continue to need address space that is globally assigned. The ISP industry should not have "control" of the CA-IP-Registry, business and government need to have representation. I suggest that CAIP should not be permitted to be the IP-Registry for Canada because it does not permit Non-ISP organizations to be regular members. ISP's should also not have to fund the IP-Registry alone in that Governments and Business should contribute a representative amount to fund the organization.

And this on the reclamation of IP number space:

> A concerted-coordinated national effort to get network managers on side to 'trade-in' their current 192.x.x.x - 194.x.x.x networks for something more reasonable would be a Good Thing(tm). Most of these networks were provisioned years before CIDR and NAT techniques, thus whole blocks of IP address space could be reclaimed. I'm giving back 192 address blocks in an effort to 'do the right thing.' I have been moving in that direction for a couple of years and only have a couple of networks left to renumber.

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