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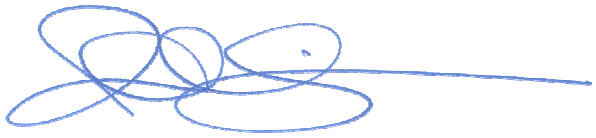
Subject: APNIC's response to the Consultation Paper on Issues Pertaining to Next Generation Networks (NGN) by the Telecom Regulatory Authority of India by the Telecom Regulatory Authority of India

Dear Shri S.N. Gupta,

APNIC has taken the opportunity to review the consultation released by the Telecom Regulatory Authority of India on 12 January 2006. Attached are APNIC's responses to the paper. I hope you find APNIC's submission of use in developing your recommendations on Next Generation Networks in India.

With best regards,



Paul Wilson
Director General
APNIC

APNIC's response to the Consultation Paper on Issues Pertaining to Next Generation Networks (NGN) by the Telecom Regulatory Authority of India

This part of APNIC's response is in relation to specific questions asked by the Telecom Regulatory Authority of India within the consultation paper. The second section of the response contains further comments on issues raised by the consultation paper.

4f. Is IPv6 an essential feature of IP transport for the migration to NGN? Does it have cost implications on the migration to NGN?

It is well known that in today's IPv4-based Internet, the relatively limited number of available addresses has encouraged the use of certain techniques and technologies, such as Network Address Translation (NAT) in particular. These technologies have compromised the ability of the network to diversify in terms of applications. The limited size of IPv4 address space imposes a strict limit on the ability of the network to grow substantially, for instance to two or three orders of magnitude larger than today's Internet. If such growth were to occur using IPv4 address space, additional and substantial architectural compromise would be required, which would further reduce the simplicity, integrity and uniformity of the network.

Because a global production NGN is expected to be very much larger than today's Internet, we suggest that the deployment of IPv6 will be required, and that discussion of NGNs should assume that IPv6 will be used. Of course, many expected features of NGNs can be developed and tested on an IPv4 infrastructure. In fact, the Internet itself is providing the testing environment for many technologies which are still experimental, and for others which are now well established and commercially viable.

IPv6 transition is the subject of intensive work in the standards, developer and vendor arenas. While costs will certainly be incurred, the transition standardisation effort is aiming to ensure that IPv4 and IPv6 can coexist within the Internet, allowing a gradual transition of users, applications, and networks to occur, independently and according to their own specific needs. In this way, costs are distributed and incurred by organisations according to their own priorities and business planning.

In short, any cost analysis for a transition of existing services to NGNs must assume that an IPv6 network is in place, or include the cost of transition to IPv6 from existing IPv4 infrastructure.

Finally, it should be noted that not all expected features of IPv6 have been finalised. In many cases, IPv6 features specified and available in RFCs (Requests for Comments) and draft documents published by the IETF (Internet Engineering Task Force) still contain unresolved issues. Therefore, any planned NGN service must take into account the state of development of IPv6 standards at that time, and the availability of robust production-standard implementations.

Because of the specification and implementation issues with IPv6, if IPv6 is specified as the Internet protocol to be used by India's NGN, it is important to ensure that any implementations chosen pass the current conformance testing performed by the TAHI project. TAHI lists the IPv6 capabilities it tests for on the following web page:

http://www.tahi.org/conformance

In particular, on the above web page, please take note of the RFC and draft documents released by the IETF listed under the heading "3. Conformance Test Coverage".

Two issues raised by the consultation paper

1. Definition of an NGN

On page 8 of the consultation paper, point (i) states:

> *"A Next Generation Network (NGN) is essentially an IP based network that enables any category of customers (residential, corporate or wholesale) to receive a wide range of services (voice, video, data etc.) over the same network. IP access is enabled across a wide range of broadband technologies, both wireless (3G, WiFi, WiMax etc.) and wireline (copper DSL, cable, fibre, power lines etc.). In NGN, the service layer is independent of the underlying network, thus a whole range of 3rd party service providers can offer services to customers and the customer is not bound to take all services from only the access provider".*

We note firstly that, according to this definition, an NGN is indistinguishable from any standard internet service network. Any of today's internet networks, and indeed the Internet itself, can be accurately described in the same way, as a multi-service IP-based network, deliverable by a wide range of technologies through a layered architecture which allows user services to be delivered separately and independently from the underlying access service. In this sense, we find that this definition is not as helpful as is could be, and that the precise relationship between so-called NGN and Internet networks should be clarified by the definition.

We suggest that an NGN should be further defined as an internet network infrastructure (which may include a collection of independently operated networks) which provides certain specific features, and satisfies certain specifications. In accordance with common expectations of NGNs, these specific features could include the concepts of *size*, in which it is assumed that the global network of NGNs will eventually be orders of magnitude larger than today's Internet; *universality*, in that NGNs are expected to carry every application service which is required by any network user; and *ubiquity*, in that an NGN is assumed to be available and used as the medium of delivery for every network service.

We specifically suggest that the definition of NGN should include the following:

> "An NGN is envisaged as an internet-based network infrastructure, and a component of the global Internet, which is used as a single ubiquitous underlying infrastructure for all required communications services, for all users in a given country or community. The term "NGN" may refer to a single-operator network or to a collection of networks within a given country or communication, while the term "Global NGN" refers to an anticipated stage of evolution of the Internet in which that network is seen to satisfy the expectations of NGNs as described here."

2. Migration to IPv6

On page 62 of the consultation paper, the first paragraph of section b) states:

"IPv6 is the upgraded version of the current Internet Protocol version, IPv4. It has already been fully specified by the IETF but has not been widely implemented yet".

Here it may be useful to make a distinction between "specification", "implementation" and "deployment".

IPv6 is specified in various RFCs produced by the IETF, and most specifications have been developed in enough detail to allow many applications and hardware (for example, routers and operating systems) to implement IPv6 capabilities.

However, there are still some areas of the IPv6 protocol that have yet to be fully specified. Mobility is one such example of a feature yet to be fully specified in either IPv4 or IPv6. As noted in APNIC's response to Question 4f above, there are some problems still to be fixed with the specification and implementation of IPv6.

Although IPv6 has been implemented in many applications, use, or "deployment", of IPv6 is still relatively limited; at the start of 2006, IPv6 was deployed by 3% of the world's network providers, accounted for 0.4% of the global Internet address announcements, and contributed to around 0.0001% of the total traffic volume on the Internet.

For a full list of the current IPv6 specifications described in RFCs, please see the RFC Sourcebook's list of IPv6-related RFCs at:

http://www.networksorcery.com/enp/default0704.htm

The second paragraph of page 62 begins:

"The key drivers towards IPv6 are the additional address space provided and the mobility features inherently implemented in IPv6".

It needs to be clarified that the large address space available should be considered as the key driver for IPv6 adoption. Mobility options are available in a more mature form in IPv4, so should not be considered as a key reason for adopting IPv6. Similarly, multihoming, which is also of interest to the mobility sought for India's NGN, is readily available in IPv4; while multihoming specifications for IPv6 (namely the SHIM6 standard) are still being developed.