Title: Barriers to IPv6 Deployment

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Introduction:

The aim of the EC IPv6 Task Force (http://www.ec.ipv6tf.org/) is to ensure the smooth and timely introduction of IPv6 in Europe. To achieve this aim the IPv6 Task Force is putting in place a number of initiatives to overcome the barriers and hurdles in deploying IPv6 in Europe.

This short document was requested at the January 2003 London IPv6 Task Force meeting and is a compilation, in no particular order, of the barriers to IPv6 deployment highlighted by the IPv6 community.

Barriers Identified:

Standards[1]: Stable standards are required to encourage companies to develop equipment and enable interoperability. In particular, Mobile IPv6, DHCPv6 (and maybe Flow Label) need to be stable so interoperable implementations can be developed and deployed. As examples Mobile IPv6 is seen as one of the advantages of IPv6 but cannot be deployed yet and multi-homing and renumbering are crucial for large/medium enterprise customers but after lots of effort we are still without an agreed solution.

IPv6 Access: There has been much research and development in the IP core area but the most widely used IPv6 access to these emerging IPv6 cores is via tunnel-broker type services. More IPv6 research and development in the IPv6 edge needs to be undertaken so that there is a range of interoperable and stable commercially available equipment.

User/Network Interface: There are currently a plethora of standards that apply to the user/network interface area, but to achieve mass and interoperable deployment between users equipment and various network offerings an industry agreed user/network best practices guide needs to be established. This would allow equipment manufacturers, network providers and users to manufacture, install and purchase equipment with the knowledge that it will fully interoperate with their existing environment.

DNS: There are many issues with DNS and IPv6 especially when interworking and DNSsec are also considered. These will be more fully elaborated in a separate IPv6 TF document but further investigation is required to ensure that the current DNS system does not degrade with the introduction of IPv6.

Zero Configuration: IP is still reserved for the technically aware! To meet the expectations that every home will have many IP aware devices we must have a complete and robust zero configuration or 'plug-and-play' architecture. More research and development is required in this area to allow a device purchased in the

[1] Considerable progress was made at the ietf56 meeting on furthering DHCPv6, Mobile IPv6 and Flow Label towards standards.

supermarket to be taken home and gain IP connectivity with the user having zero knowledge of IP.

Security: Much has been discussed about the inclusion of IPsec as a mandatory part of a "full implementation" of IPv6, however, at the moment, not many IPv6 stacks include IPsec. Inclusion of IPsec needs to be encouraged and solutions found to the automatic distribution of keys in the circumstance that a widely available PKI solution is unlikely to happen. Security in its widest sense needs further investigations in all areas e.g. is it possible to use the authentication mechanism (AH) to replace parts of PPP, what are the real concerns on privacy – does security help or hinder.

Network management: Products in this area are scarce, vendors need to be encouraged to develop IPv6-enabled solutions and new methodologies that IPv6 may facilitate need to be researched. Support for IPv6 in MIB's is currently poor as is IPv6 transport for SNMP.

IP version-neutral applications: Nearly all current applications use IPv4, many are starting to be ported to IPv6. However, in some instances, porting IPv4 applications to be capable of working with IPv4 and IPv6 can be difficult. Is there a requirement for "best practices" guide? better education? an IP version application label scheme?…

Consumer devices: Currently there are very few IPv6 capable consumer electronic devices – those that are available are predominately Japanese and oriented to the Far Eastern market. Is it just a matter of time? or can European industry be stimulated in producing conventional devices that are IPv6 capable and by "looking outside the box" can IPv6 with its inherent capabilities enable new markets. This is almost a chicken and egg problem, no devices because no IPv6 network, so no clear advantages. There are already some applications available that suffer from NAT and would benefit from IPv6 e.g. VoIP and conferencing applications but operators and access providers do not seem to bother. Mobility of wearable devices across different residential networks would be a clear advantage. The problem is: IPv6 on its own will not be required by end users, functionality of appliances and applications will be the discriminator.

Awareness: IPv6 is gaining momentum but considerable training of conventional IPv4 engineers needs to be undertaken and awareness increased in industries that currently do not use IP but to which IPv6 could bring benefits. One of the problems is that there are not that many industries that are as well organized as the mobile telephone industry. Contact needs to be established with the Car manufacturers, broadcasting world, ISP organizations etc.

Host OS Support: Many operating systems support IPv6 to some degree. Full support in the most popular end host operating system would stimulate demand. Support for RT kernels for embedded systems is another issue if one wants to develop consumer devices.

Transition: Considerable effort has already been expended on transition and interworking technologies – there is however still a considerable amount of confusion. Clear guidelines need to be produced and discussed on what are the best options in a number for circumstances. There is also some interoperability of interworking mechanisms work that needs to be performed to recommend which of the plethora of interworking technologies are compatible with each other within a particular network domain.

Business Case: What is the business case (main incentives) for companies to invest in IPv6 when the current economic climate is forcing people to save costs? A clear list of economic advantages of IPv6 needs to be articulated.

Technical Case: In a similar fashion to the business case a clear technical guide to deployment is needed. This needs to cover what the most imminent steps are for IT people to consider over the next 2-3 years.

Advantages: Some of the claimed advantages of IPv6: Mobile IPv6, Multicast, Plug and Play and even NAT avoidance, have not been quantified. Some of this may be coved by the business case activity but a clear business benefit from these technologies needs to be articulated.