

# **Internet Society Organization Member IPv6 Study**

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## **Abstract**

The Internet Society (ISOC) conducted a study of the operational characteristics of IPv6 in its organization members' networks. This was done through a questionnaire sent to the organization members. The organization members that responded to the survey reported that while customer pressure motivated IPv6 deployment, specific business-case drivers did not yet exist. While respondents who had begun IPv6 deployment reported gaps in support for IPv6 among tools and applications, they found the process of deploying IPv6 relatively straightforward. This report provides additional details about the results of that study.\*

## **Background**

The Internet Society (ISOC) has approximately 90 organization members (<http://www.isoc.org/orgs/>). Organization members are diverse types of organizations from around the world, ranging from small companies to large corporations, Internet service providers (ISPs) to enterprises, vendors to network operators. All of these organizations operate a network of some sort and, due to their diversity, provide a wide cross section of use models for IPv6. In 2008 ISOC conducted a study of how organization members use IPv6 in their networks.

Internet Society organization members include various ISPs, Internet exchange point operators (IXPs), enterprises, national research and education networks (NRENs), and network equipment and software vendors. The networks they operate range from very small networks in a single office to large networks spanning multiple facilities and multiple geographical areas. ISOC was keen to determine the level of operational penetration that IPv6 has in these networks, to understand something of the thought processes organization members went through in evaluating the usefulness of IPv6, and to learn of their experiences in adopting it. ISOC was not interested in determining through the study information about specific vendors' product capabilities or details about commercial operational differentiators. ISOC committed to keep the contents of the responses anonymous when presenting the results of the study.

## **Summary of the Study**

ISOC conducted a few preliminary interviews with organization members to help determine how to go about collecting data, which specific kinds of information to seek out, what questions to avoid, and how to present the participation request to make the commitment and effort required by the organization members as palatable as possible. We realize that participating in such a study is an activity that is in addition to the normal responsibilities of the individuals involved, and we are very grateful for all the effort that the individuals from our member organizations made to provide this information.

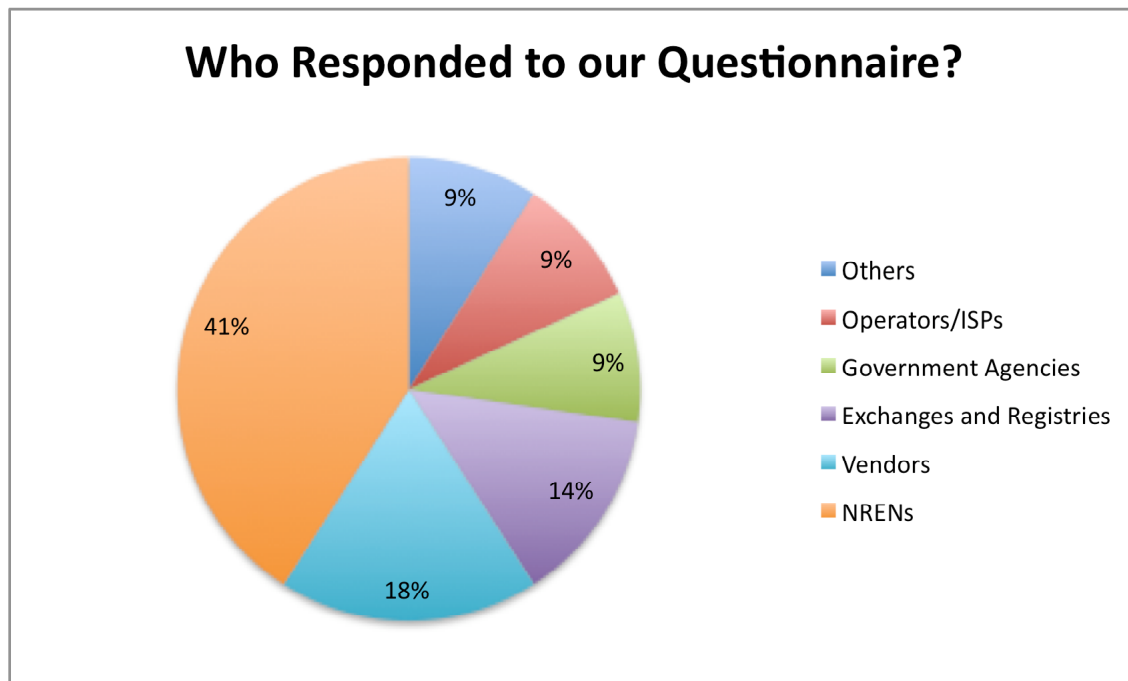
ISOC conducted the study by sending a questionnaire to its organization members with a request to find the appropriate individuals within the respective organizations who operate networks and have responsibility for IPv6 deployment within the organizations. The representatives of the organizations did an excellent job of

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\* This report may be found at: <http://www.isoc.org/pubs/Report-OrgMemberIPv6Study-200903.pdf>

getting the questionnaire into the right hands in their respective organizations. We are very pleased that people took the time to thoughtfully complete the questionnaires and also that many of the individuals who completed the questionnaire agreed to be contacted by way of follow-up for more detail.

Unsurprisingly all of the organizations that responded by completing the IPv6 Study Questionnaire are in the planning stage for IPv6 at least, and most have begun deploying IPv6 at some level. ISOC committed to keeping the results confidential and that any summary presentation of the results would be kept anonymous. Therefore, the results presented through public presentations and in this report do not divulge any specific information about any of the ISOC organization members.



The questionnaire had both multiple choice and open-ended questions to elicit more detailed responses from the individuals completing the questionnaire. The questionnaire had five major sections: IPv4 Utilization and Runout Questions; IPv6 Planning Questions; IPv6 Operational Questions; Recommendations for Others Intending to Deploy IPv6; and Recommendations for those not Planning to Deploy IPv6.<sup>†</sup> The following sections describe the responses to the questions.

### ***IPv4 Utilization and Runout Related Questions***

Responses to the question about the size of the network the organization members operate ran from the smallest network having five IPv4 addresses (not blocks, individual addresses) up to more than a /8, representing about 16 million individual IPv4 addresses. When asked about the utilization levels of those address blocks, there were a couple of responses of very light utilization levels (only 6% of addresses in use in one case), but most reported that they maintained high utilization levels (of say 80% or more) in their address space. None of the really big allocations had low utilization levels.

<sup>†</sup> A copy of the questionnaire can be found at: <http://www.isoc.org/pubs/Survey-OrgMemberIPv6-2008.pdf>

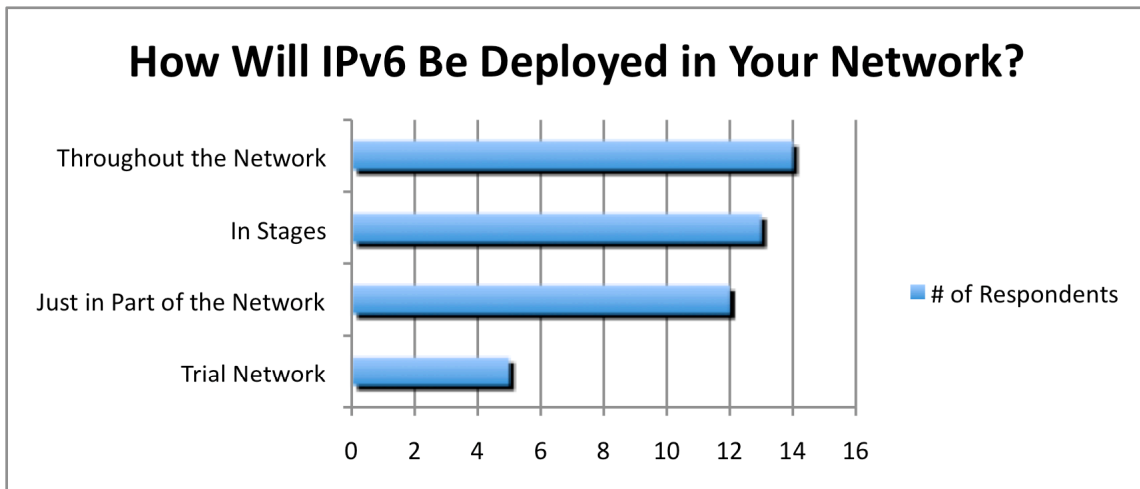
While 9 out of the 22 who responded expect to ask for more IPv4 address space soon, it is often hard for them to quantify how much additional space they expect to request. The largest request anyone who responded articulated was for a /15, representing about 130,000 individual IPv4 addresses. That particular organization tracks its utilization and addressing needs quite closely and knows that it needs a new /15 about every three years.

We asked about what an organization expected to do if it were not possible to get more IPv4 addresses in a future request. Most respondents said that they would make more extensive use of network address translation (NAT) technology. Some thought they would be able to reengineer their networks through renumbering but only two of the respondents suggested they would use IPv6 to address this problem.

Our last question specifically on IPv4 runout asked whether an organization would be willing to return any unused IPv4 addresses. Only two respondents thought that might be possible and most pointed out that although they either have transitioned or expect to transition to IPv6, they also expect there to be a long to very long period of coexistence where they will continue to use their the existing IPv4 address allocations. Some respondents also pointed out that there are parts of their networks that will continue to use IPv4 as long as that part of the network operates as it will simply not be possible to convert the applications running on those networks to IPv6.

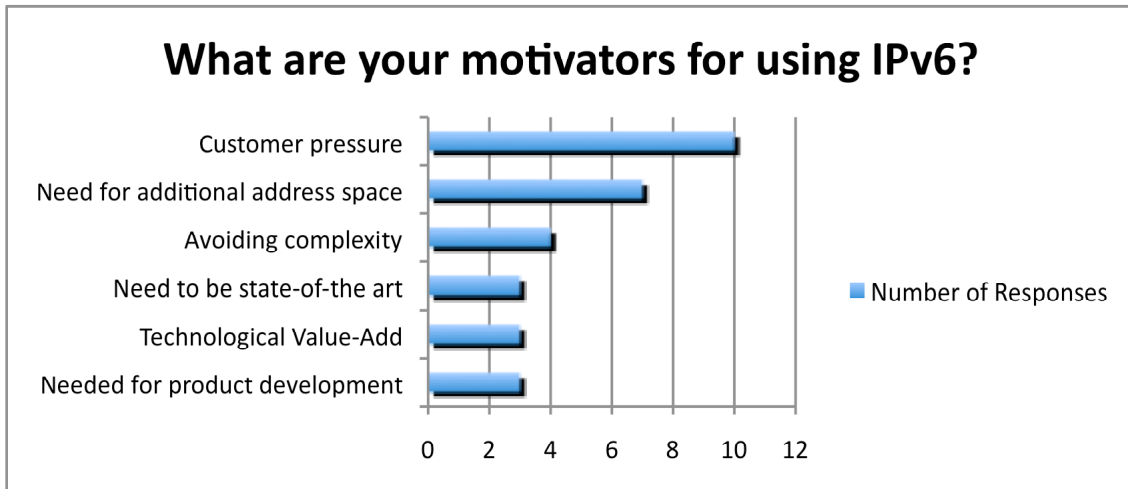
### **IPv6 Deployment Questions**

When asking about how organization members had deployed or intended to deploy IPv6 we used a multiple-choice format that did not yield completely clear answers due to multiple answers being possible. It was interesting to observe that a little over half of the responses we received stated that IPv6 was to be deployed only in parts of their networks. And here again several reported that they envision parts of their networks never operating with IPv6.

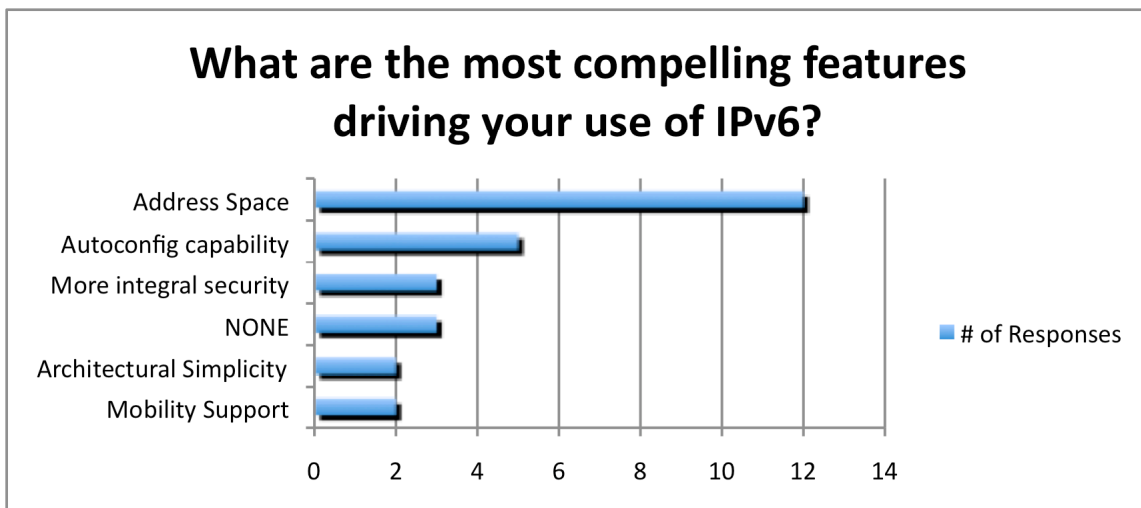


We asked a few questions about the motivations for using IPv6. Almost half of the respondents (10) stated that demand from customers was the main driver for their deployment of IPv6. This was often coupled with a need to validate product offerings on IPv6. A related question about specific business drivers gave us two very clear kinds of responses: that while there were no concrete business drivers for IPv6, the

technology was being driven by a general perception about customer demand and a need to be prepared for the next large technology step in the evolution of the Internet.



We left room for multiple choices to describe the most compelling features of IPv6. A little more than half of the respondents (12) listed additional address space as a motivator. We also had responses from individuals who liked the automatic and simple configuration capabilities (5), more integral security (3), mobility support (2), and architectural simplicity (2). Three respondents clearly stated that there is no most compelling feature for IPv6. Several people commented here and elsewhere about how much easier they found configuring the IPv6 parts of their network compared to what they had expected. There were clearly some reported “gotchas,” as is to be expected with any new technology, but many who commented thought the deployment of IPv6 was relatively straightforward.



Of those who responded, only three member organizations are in the early stages of deployment, while 15 stated they were satisfactorily underway and three others characterized IPv6 as being fully deployed in the networks they operate.

We tried to find some way to understand the different kinds of network deployments people face. In large corporations there are often many different networks spread

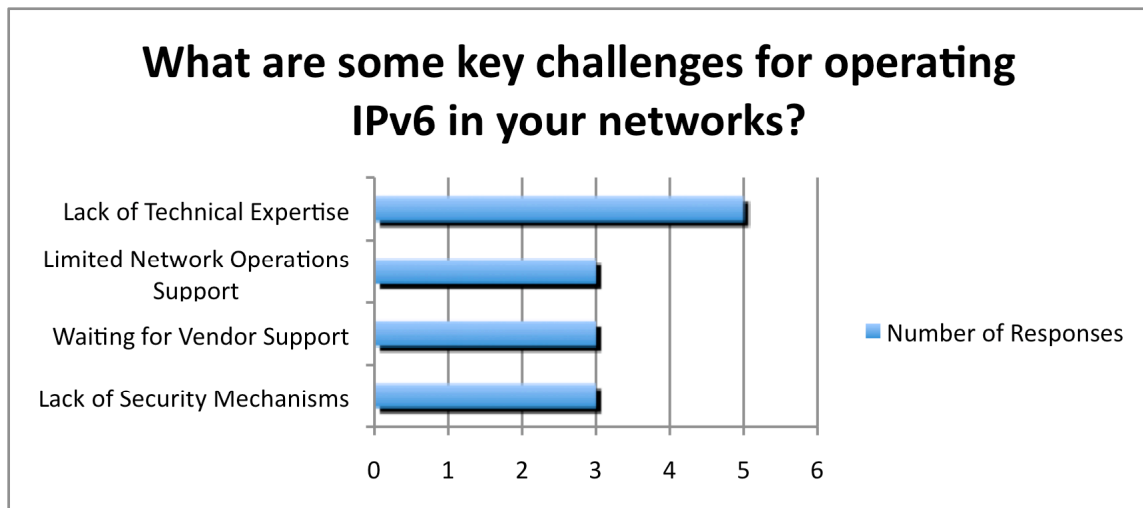
around a country or around the globe that make up their internal networking infrastructure. Some of these networks are for internal use only and some are customer or external world servicing networks. For respondents with this kind of networking infrastructure, we asked whether they were implementing IPv6 on internal networks only, external networks only, or both. Most of the responses to this question indicated IPv6 would be deployed on both internal and external networks, with several respondents clarifying that they were beginning with the external facing part of their network being IPv6 capable and the internal part coming later.

We asked what kind of technological implementation path had been chosen for IPv6. Most respondents (17) are using dual-stack, running IPv4 and IPv6 side-by-side. Ten respondents used some kind of tunneling to implement IPv6 on top of their existing IPv4 networks. However, tunneling was largely viewed as a temporary measure that either had been phased out or would be phased out in the near future, including when their upstream networking provider offered native IPv6 service. Ten respondents stated that they had part of their network running a native IPv6 deployment.

We asked whether the organizations would like to reserve part of their IPv6 allocation for internal use only. Six of the respondents said yes, though most weren't sure how they would do this. Some said they would announce their whole range of addresses and filter at the firewalls for addresses that they intended for internal use only.

### ***IPv6 Deployment Challenges and Recommendations***

The questionnaire contained a few questions about the challenges organizations encountered when deploying IPv6 and the recommendations they had for others who were starting down the path of IPv6 implementation.



We heard again that organization members were pleasantly surprised about how their own particular experience of implementing IPv6 was less complicated than they had anticipated. Still, they emphasized that operating IPv6 in a network or part of a network is a new experience for the individuals involved and that training is perhaps the most important need because there are new aspects to operating an IPv6 network. Five of the respondents identified this lack of technical expertise as being

the main challenge when beginning to operate IPv6. Four mentioned limited operational support from tools and systems, lack of security infrastructure, and inadequate support from vendors. A couple noted that this latter problem is much less now than it had been as vendors were more responsive to requests for IPv6 features and support.

The respondents stated that a key missing element in IPv6 is the lack of support for IPv6 in applications. Although no specific applications were mentioned, many applications embed knowledge of the IP version number into the implementation (specifically the address encoding) that makes it difficult to get them to run on the new protocol. Others mentioned that many support tools that have been developed for IPv4 have the same limitation. In particular, network management systems were singled out as being a bit behind the curve in their support of IPv6.

## **Resources**

The organization members who responded to our questionnaire suggested some of the following resources as particularly useful for the deployment of IPv6:

<http://www.nic.ad.jp/en/ip/ipv4pool/ipv4exh-report-071207-en.pdf>

[http://www.soumu.go.jp/joho\\_tsusin/eng/pdf/080617\\_1.pdf](http://www.soumu.go.jp/joho_tsusin/eng/pdf/080617_1.pdf)

[http://www.soumu.go.jp/joho\\_tsusin/eng/pdf/080617\\_2.pdf](http://www.soumu.go.jp/joho_tsusin/eng/pdf/080617_2.pdf)

<http://www.6diss.org/>

<http://www.6deploy.org/>

<http://www.ipv6tf.org/>

<http://www.6net.org/>

[http://www.getipv6.info/index.php/Operational\\_transition\\_information](http://www.getipv6.info/index.php/Operational_transition_information)

<http://www.civil-tongue.net/6and4>

[http://www.ripe.net/ripe/meetings/ripe-56/presentations/Colitti-IPv6\\_at\\_Google.pdf](http://www.ripe.net/ripe/meetings/ripe-56/presentations/Colitti-IPv6_at_Google.pdf)

<http://www.nist.gov/director/prog-ofc/report05-2.pdf>

<http://www.oecd.org/dataoecd/7/1/40605942.pdf>