IPv6: the next generation of IP is available on the GARR network

GARR makes available on its network IPv6, the next generation IP protocol and supports users in its implementation. The new version of the protocol enables innovative network services and new functionalities in applications.

The key feature of IPv6 is a much wider addressing space. For this reason, IPv6 is the solution to the shortage of public IP(v4) addresses due to the constant expansion of Internet worldwide. It is foreseen that, by 2012, the whole range of public IPv4 addresses will be allocated. Since that moment on, new users and services will be reachable via IPv6 only.

IPv6 may simplify the configuration of IP networks and help introducing new services over the Internet. Thanks to the high number of available IP addresses, the new protocol enables innovative applications, i.e., for instance, those requiring the interconnection of common devices, such as telephones or even household appliances, that will exchange information between them, or connect to the Internet.

Nowadays, ISPs do not allow each network node (i.e. computers, personal digital organisers, smart phones) to be reachable directly from outside the provider's private network. To spare public IP addresses, ISPs usually configure their users as a private network group, whose members get private addresses and access the Internet through gateways. This technique needs a limited amount of public IPv4 addresses for the gateways, but poses limitations on the user's capability and network transparency.

The uptake of IPv6 will facilitate the use of advanced applications and services and enable end users to easily become themselves public content and services providers, playing a more active role on the network.

New features

The main innovations introduced by IPv6 are:

- **a much wider address space**: the address grows from 32 bits to 128 bits, offering 2^{128} different IP addresses. Such abundance of public IP addresses will fulfill and exceed the growing demand, while facilitating those applications that require or benefit from a large amount of public addresses, such as, for instance, peer-to-peer, grids, and domotics;
- **support of users mobility**, who will be enabled to access the network with the same IP address, regardless their location, without any need of manually re-configuring their devices network settings;
- **an integrated protocol to enforce security**, using an embedded data encryption and authentication system;
- **a mechanism for the automatic registration and configuration of IP addresses**, making the usage of devices simpler and more transparent for the end users;
- **a more flexible and extensible protocol architecture**, that allows further extensions and enhancements without the modification of the protocol itself.

Domotics: an IP address for each device

One of the most interesting consequence of the increased availability of IP addresses will be the opportunity to allocate an IPv6 address to each device, from washing machines, to ovens, mobile phones, clothes, etc.. IPv6 will foster domotics, the so-called discipline dealing with the remote control from Internet of a large number of devices and objects in each house.
The potential applications are virtually countless: real-time control of remote sensors in disaster monitoring systems, automated power control to optimise the use of public lighting and the so-called "smart homes" containing programmable and remotely manageable appliances.

IP
The Internet Protocol (IP) is a protocol used to convey data in a packet-switched network. It is the network layer protocol of the Internet Protocol Suite and it has the task of delivering datagrams (packets) from the source host to the destination host solely based on their addresses. The addresses are 32 bits long in IPv4 and 128 bits long in IPv6.

Peer-to-peer
Peer-to Peer is a communication model, where each party has the same role and can initiate a communication session. In the common language, the term is often used to describe applications that allow users to exchange data and share resources through the network with multiple users at the same time.

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IPv6 and the Research and Academic community

Having funded several R&D projects to give momentum to development and adoption of IPv6, the European Commission has recently set the objective of migrating at least 25% of private enterprises, Public Administrations and private customers in Europe to the new protocol for 2010.

The European investment on IPv6 deployment and testing has caused GARR and the European NRENs to become leaders in the introduction and provision of the new protocol. As a matter of fact, GARR and the European NRENs are already fully IPv6 ready, also thanks to the experience gained in the framework of 6Net, an EC-funded project begun in 2002 with the goal of developing and testing IPv6 in a real life field test conditions. GARR was the 6Net coordinator for Italy and created a nation-wide IPv6 testbed, that ran in parallel with the GARR production Network.

Various end users took part to the testing phase and connected to the test bed. After the end of the project (June 2005), GARR made gradually available the v6 protocol on all its production network.

The GARR Network is dual-stack, i.e it is capable of providing both IPv4 and IPv6 connectivity to all its end sites, wherever located. From the very beginning, the GARR user community followed the development of IPv6 with eagerness; several GARR users are early adopters, and more are joining them.

IPv6 is available on major operating systems and applications (for e-mail, web servers and clients) which can use both protocols, as shown by the experience of several universities, which have already configured their students' computers with the dual-stack IP version.

Activating IPv6

The GARR network can provide IPv4 and IPv6 connectivity to all its end sites. IPv6 is a non-exclusive and parallel solution and can coexist with IPv4 on the same physical infrastructure without conflicts. Thus, a gradual migration to IPv6 does not create any clash or issue with existing services using IPv4. It may however require some changes in the way networks are usually planned and managed. While migrating to IPv6, LAN administrators should develop and test new procedures for planning and maintaining their local networks, as well as pay a special attention to security, and to the accessibility of services. Furthermore, it is important to check the IPv6 compliance of network equipment.

To activate IPv6 on their access link to GARR, the Access Port Manager (APM) of the organization has just to send an initial e-mail of request to the GARR network operation centre (noc@garr.it).

The GARR-NOC will provide the information and support for activating IPv6 on the organization's access routers. A wide set of technical documents is available to further support the users in configuring their LANs and the connected end nodes.

NREN

NREN is an acronym for National Research and Education Network. The NRENs network is usually a single telecommunication network domain interconnecting universities, research centers and other scientific/cultural organizations at the national level.

6net

An EC-funded project which begun in 2002 and ended in 2005; during its lifetime, it created an international pilot infrastructure to test the IPv6 protocol under realistic conditions and laid the foundations for the current IPv6 offering in NRENs.

http://www.6net.org

NOC

The Network Operation Centre (NOC) is responsible for managing and controlling the GARR network infrastructure; NOC tasks include failure management, activation of new circuits, collection and publication of network statistics.

http://www.noc.garr.it

APM

APMs (Access Port Managers) are network experts that act as a official technical point of contact for their organization to GARR.

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