

The evolution of the Italian Research and Education Network

M. CARBONI

GARR, The Italian Research and Education Network - Via dei Tizii 6/b, 00185 Rome, Italy

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Summary. — Consortium GARR is the organization that plans and operates the Italian Research and Education Network. GARR facilitates the financial and technological synergies that led to the creation of the GARR network and enables its evolution. In this paper we briefly recall the existing GARR-G network infrastructure and discuss the new generation project GARR-X.

PACS 42.81.-i – Fiber optics.

PACS 42.81.Uv – Fiber networks.

PACS 43.10.Pr – Information technology, internet, nonacoustical devices of interest to acoustics.

PACS 89.20.Hh – World Wide Web, Internet.

1. – The GARR-G network infrastructure

The existing network infrastructure operated by Consortium GARR [1], called GARR-Giganet (GARR-G in brief), shown in fig. 1, has an overall capacity of more than 100 Gbit/s; it provides users with access bandwidth of the order of Gigabits per second and a wide set of services. GARR-G is interconnected to other Research and Education Networks in Europe and worldwide through the pan-European backbone for research GÉANT2 [2]; in addition, peering connections are established with major national and international Telecom operators and Internet Service Providers.

2. – The next generation network infrastructure: GARR-X

The growth of network traffic, and especially the components connected to research activities, highlighted in fig. 2, as well as the need of providing new services, push towards the adoption of a new network model, more oriented to the requirements of the GARR user community, both in terms of performance and scalability. In order to implement such model, a direct control on the Transport Layer of the network is envisaged (at the moment this Layer is managed by telecom operators in the current infrastructure). This paradigm shift is a major step towards the evolution of the existing network infrastructure towards a new generation one, called GARR-X [3].

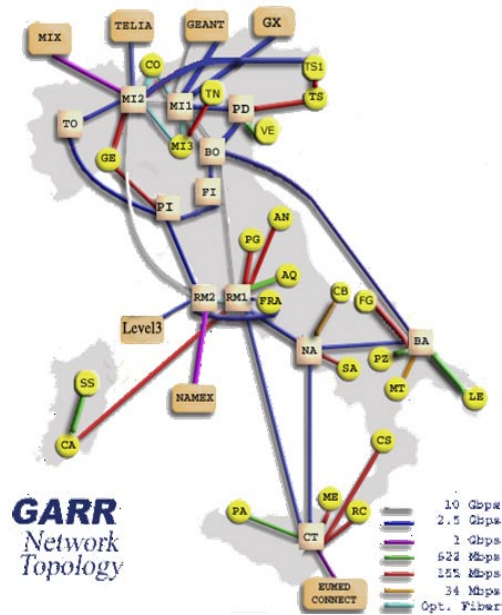


Fig. 1. – GARR-Giganet.

The following factors are regarded as major enablers for the new model: the ownership of dark fiber, both for backbone and access links and the adoption of the Dense Wavelength Division Multiplexing (DWDM) technology, exploiting equipments with multi-degree ROADM feature. Such feature allows the dynamic management of complex network topologies, Sub-lambda Multiplexing and Switching, in order to optimize the bandwidth usage of optical signals. Such equipment should be complemented by appropriate management, monitoring and reporting software packages to allow for the daily maintenance of the infrastructure.

Figure 3 shows a schematic overview of the infrastructure planned for GARR-X. The pervasive distribution of network resources over the country will provide an effective

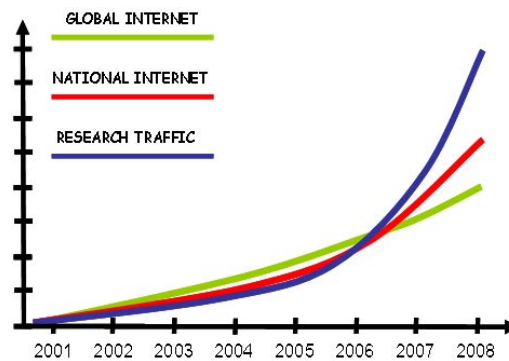


Fig. 2. – GARR Traffic evolution.

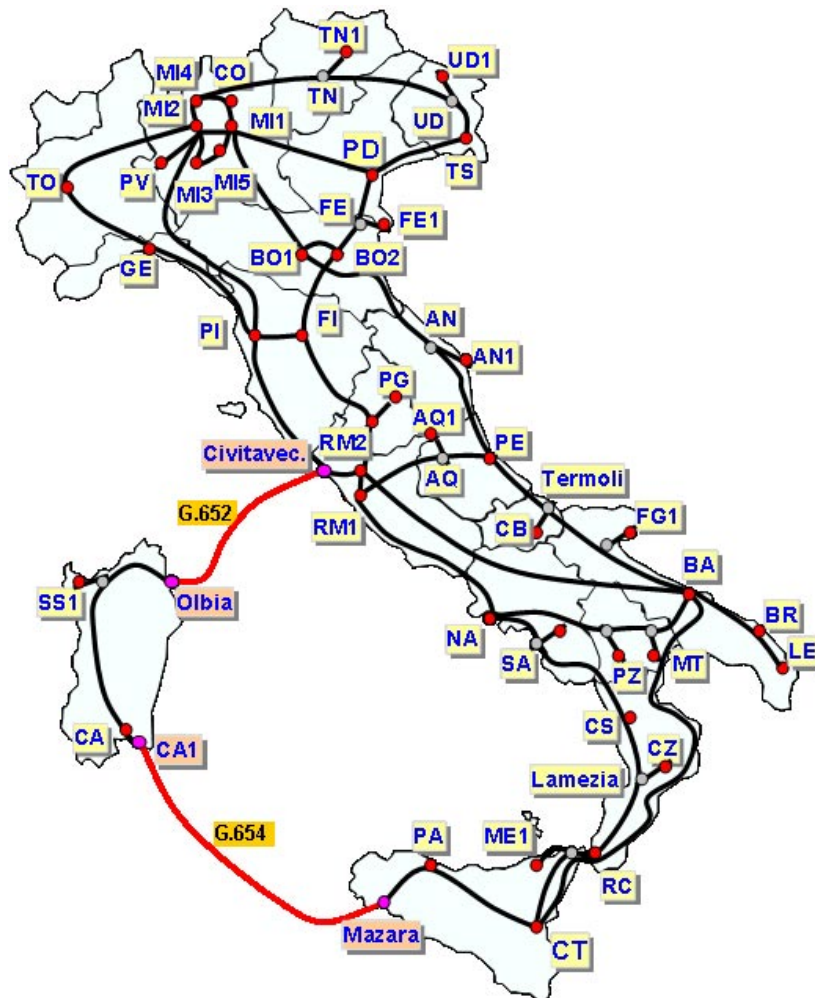


Fig. 3. – GARR-X Network Infrastructure.

contribution to bridging territorial differences in the availability of services and broadband access to the network, thus fighting the Digital Divide and providing an effective support to research and education activities across the whole national territory. The development and integration of Campus, Metropolitan and Regional networks on the whole national territory, thanks to the synergies with Universities and Local Administrations, will also contribute to achieve this objective. Another distinctive element of GARR-X is represented by the increase of the global capacity of the network (40 times the capacity of GARR-G).

This is possible thanks to the activation on the backbone of optical flows of 10 Gbit/s, 40 Gbit/s and, in the near future, 100 Gbit/s and also because GARR-X will be shaped in order not to have bottlenecks at the level of the users access links. In GARR-X, very sophisticated and efficient monitoring devices will allow to increase the reliability of the network and to speed up the service delivery. Also, in GARR-X new services will be

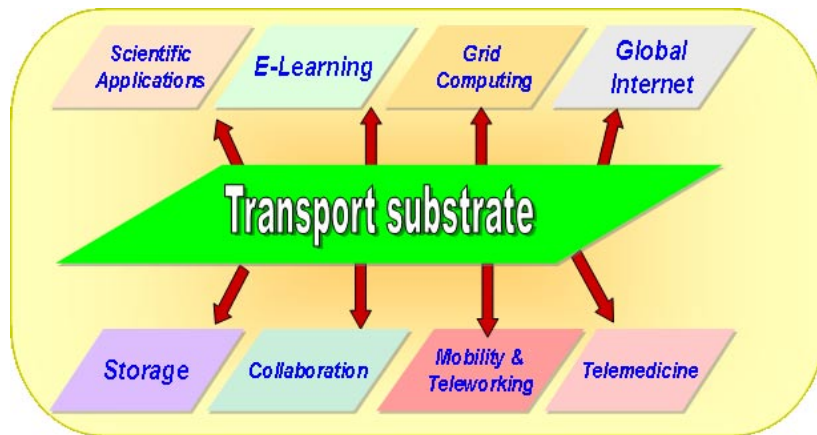


Fig. 4. – GARR-X Multiservice Network.

available as for example the Virtual Private Networks (Optical VPN, L2 VPN, L3 VPN), and the virtualization of network and computing resources. Ultimately, the provisioning of the current available services (as the Bandwidth-on-Demand) will be simplified.

GARR-X will be a multi-service network capable of supporting different networks at the same time and on the same transportation level. These networks will be shaped by the users according to their requests and objectives as shown in fig. 4. All these services are based on the agreed specifications with the other Research European Networks and will be supplied end-to-end all over Europe. This will promote the participation of the GARR User Community at international activities of Research and Education. GARR-X wants to be an advanced platform for testing and circulating in Italy of advanced applications as GRID, teleworking, E-learning applications as Telemedicine and access and multimedia fruition to museums and libraries.

REFERENCES

- [1] www.garr.it the Italian Research and Education Network.
- [2] www.geant2.net PAN European Research and Education Network.
- [3] www.garr.it/reteGARR/garr-x.php GARR-X project home page.