RPCNET - The first Italian computer network (1970-1985)

Luciano Lenzini tells the story

In the early 1970s the CNUCE started a collaboration with the IBM Scientific Center in Pisa, in Via S. Maria, right in front of its headquarters. Thanks to this cooperation, four researchers from Pisa, two from CNUCE (Renato Matteucci and myself) and two from the IBM Scientific Center in Pisa (Paolo Franchi and Alessandro Fusi) moved from 1973 to 1974 to the IBM Science Center in Cambridge, Massachusetts (USA) in order to learn more about computer networking. There we were able to count on the collaboration not only of researchers from IBM scientific centers (starting precisely from Cambridge), but also those of other US research institutions. In particular, I remember specifically in those months the exchanges of ideas of our group with the designers of the IBM Watson Research Center in Yorktown Heights, which was working on the IBM proprietary architecture called Systems Network Architecture (SNA), and also with some designers of BBN of Cambridge engaged in ARPANET, as well as with the designers of the MERIT network developed at the University of Michigan.

In June 1974, the launch of the REEL (Network of Computers) project was officialized between CNEN (Information System Management Division, Bologna), CNR (CNUCE Institute, Pisa), CSATA (Advanced Technology Applications Study Center, Bari), IBM's Scientific Center in Pisa and the computing centers of the Universities of Padua and Turin. This was for the design and construction of a network of computers among the various computing centers of these institutions: RPCNET (REEL Project Computer NETwork) was formally born. These organizations signed the same collaboration agreement with IBM previously signed by the CNUCE. From the archives of the University of Turin it was possible to recover the collaboration agreements between the Turin and Padua Universities and IBM.

To give national visibility to the REEL project, CNUCE and the IBM Scientific Center in Pisa organized a press conference in Milan for Italian scientific journalists on 21 October 1976. The following day, in Venice, there was a study day dedicated to the presentation of the RPCNET architecture and protocols. The main representatives of the national scientific community and important ICT companies of the time took part, in front of a large public. For the first time a national computer network was presented, entirely designed and implemented in Italy, able to compete with ARPANET and other existing networks at the time.

At the end of 1976, the RPCNET software was already running on the IBM processors with which the REEL project partners were equipped. The IBM mini-computer System/7 (with the role of front end processor), available at some computer centers, also served

as a terminal concentrator (with functionality similar to the ARPANET TIP). Between 1976 and 1978 the RPCNET software was tested in some partner calculation centers, made more reliable and enriched with tools both for the measurement of traffic between network nodes and for the gathering of other statistical data.

Technical analysis - The architecture of RPCNET

The RPCNET architecture, as shown in the figure below, was structured in two functional levels: the first, starting from the bottom, includes the communication functions, while the second includes the interface functions.

At the application level, the RPCNET user could rely on file transfer applications (file exchange), remote access to operating systems (Internet telnet) and messaging (Internet email). We also created a set of macros (RNAM - REEL Network Access Method) with which the user could implement their own applications.

Among the communication functions, it is worth mentioning the management of physical channels between adjacent nodes, packet forwarding and the routing protocol, through which routing tables were populated and network reconfiguration was managed in the event of falls/activations of hardware/software components. Applications resident on different computers exchanged data through the logical channels made available by the interface functions. Of these I remember the flow control, the segmentation and reassembly of the blocks of data exchanged, the recovery from error situations and the dialogue control (half-duplex/full-duplex). After a few years, we find this last feature in the OSI model session level. Another important feature of the interface functions is the management of a connectionless service at the application level (the one that we come across again after a few years as a UDP service on the Internet) on which the messaging service between users was "mapped", or what is now called e-mail service.

RPCNET: from research to service (1978 - 1985)

In 1978 the General Commission for Information Technology of the CNR decided to use RPCNET in the calculation centers of the National Research Council itself and the University to implement its own national scientific calculation policy. This gave substance to the insights that Alessandro Faedo, then University of Pisa Rector and Guido Torrigiani, director of CNUCE, had had in 1970 when launching the project.

The consequence of this choice was that, from 1978 to 1985, RPCNET, the first Italian network and one of the first in Europe, connected about ten scientific computing centers stretching from Palermo to Milan. RPCNET users began experimenting with network services.

The RPCNET management experiment, completed in December 1985, showed how it was possible to integrate the hardware and software resources of the participating computer centers. Not only, but above all, valuable cultural and professional knowledge could be transferred from the most advanced computing centers, such as the CNUCE, to those of new or recent institutions. File transfer applications, remote access to interactive terminals and messaging were used increasingly by RPCNET users, as shown by the traffic measurements collected in that period (RPCNET Measurement System First Experiences).

On the other hand, a long time went by before users began to appreciate the advantages of having a local medium-power computer, with which they could satisfy particular needs (editing, setting up programs, etc.), in addition to being able to request, via RPCNET , services resident on remote computers with higher processing capabilities.

Other objectives of primary importance achieved during the experiment were, for example, the testing of various organizational structures and the rationalization of the distribution of application software in the various RPCNET computing centers.

RPCNET layered architecture

The access method to the network functionality

RPCNET and IBM

Even at IBM the skills gained from the design and development of the RPCNET network had interesting implications. In those years the PISA project (Prototype for Interconnection of Series/1 Applications) was launched between the IBM Scientific Center in Pisa and the IBM Development Laboratory in Boca Raton (Florida). The result was the design and development of a computer network prototype based on mini IBM Series/1 systems, automatically reconfigurable and with excellent performances.

The results of this project were presented in a demonstration with a group of 10 Series/1 systems interconnected with each other and 20 users working at the terminal and exchanging data and archives. The connections between the systems were changed randomly while the network was operational, but the operators continued to work without any inconvenience. Despite the more than interesting features the prototype remained as it was given the different strategy adopted in networking by IBM, known as Systems Network Architecture or SNA.

RPCNET undoubtedly contributed to creating a networking culture among users and managers of scientific computing in the CNR and the university environment, and to prepare the ground that was to facilitate the transition to the Internet in a few years' time.

RPCNET user's guide