



High Performance Computing and Telecommunication Policies at UNAM

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Abstract

The Universidad Nacional Autónoma de México have been investing an important amount of human and technical resources to incorporate GRID computing technologies to support scientific research and international collaboration. These efforts are funded on a long history of infrastructure achievements at the institution, as well as major investments on telecommunications and broadband connectivity. Since the foundation of the Mexican NREN called CUDI, the evolution of the former GRID resources, the certificate authorities to share tools, among others, UNAM have been a key participant in its development. All is a by-product of the University's expertise and knowledge in the IT sector. Following this tradition, UNAM have defined a concise set of policies to improve and take major advantage of IT innovations keeping safe the institutional goals and commitments with other organisations.

Introduction. CATIC Responsibilities.

In 1958 the first computer in Latin America was installed at the Calculation Centre of UNAM's Engineers School. What was in the beginning a project to use these "electronic brains" to facilitate huge amounts of numerical analysis, sooner was transformed in a horizontal infrastructure for the most diverse purposes alongside the University. Back in the 1960's the first University Academic Program was funded to support research and collaboration with other universities, specifically in North America. In parallel, the computing capacity was adopted as a useful tool for the administrative services. In the 1970's there were two major branches for the use of computers and related devices (storage and peripherals): administration and academic applications.

For many years these two top groups of users were developing their infrastructures and facilities with no close contact or interaction. However in the 1980's the University created a multidisciplinary organism, called de Computing Advisory Board (CAC by its initials in Spanish) with specific goals, such as to set the basic rules of IT development as well as the allowed uses of IT, investments and budgets, types of technologies, network design and operation, compatibility issues and share of information.

The CAC, nowadays transformed into the ICT Advisory Board (known as CATIC) have the following responsibilities[†]:

- I. Set the guidelines as the basis to design the UNAM's strategic plans on ICT

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[†] Source: UNAM's Rector agreement on CATIC. Gaceta UNAM. 16th February 2009.



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- II. Suggest policies to guide, support and contribute to justify the decisions taken about development, acquisition, administration and usage of ICT.
 - III. Create special or permanent committees to make research, studies and surveys that allow the CATIC members to get the necessary information to sustain their opinions and suggestions.
 - IV. Promote initiatives to keep up to date the information related to computing resources in the University, including hardware, software, computers labs, agreements with suppliers and other organisations, telecommunications infrastructure, among others, and
 - V. Promote the search for special internal and external resources to support the ICT development at UNAM.

Eleven representatives, headed by the Rector itself, integrate this advisory board. Six members come from the academic and administrative structure of the institution, which guarantees the open discussion of many topics and requirements from the most diverse areas of the University. Due that, the resolutions, suggestions and policies generated at the core of the CATIC are widely implemented.

Since its foundation, CATIC have issued diverse recommendations to acquire, implement and sustain the operation of ICT in all the arenas where the university duties resides. Every year, for example, the CATIC publishes a basic catalogue of computing architectures, peripherals and other components that must be observed by every branch office in the organisation. Most of the job made by the CATIC includes the recognisance of the technology trends, nation and worldwide, to guarantee the participation of the University in the innovation and transformation of the research and education based on these resources.

UNAM's ICT in numbers.

To support the daily activities of the University in its three main goals (education, research, and cultural extension), these are at a glance the available ICT resources:

1. Network

- a. **Data:** Red UNAM is one of the largest data networks installed in an academic institution, with more than 75K physical data ports (UTP), plus a thousand WiFi Access Points. More than 200K WiFi accounts delivered to the community.
- b. **Broadband access:** 6.5 Gpbs of connectivity to public Internet, plus 10 Gbps to the NREN (CUDI) which derives in the access to international research and education networks
- c. **Metropolitan Delta:** Dark fiber infrastructure into Mexico City's subway, interconnecting the three major campus with supercomputing capacity in equal number of institutions (72 optic wires, only 2 currently being used)



- d. **Voice:** More than 18K digital extensions, plus 750 mobile lines and a hundred VoIP devices.
- e. **Video:** Plus than 260 videoconference rooms spread all over the national and foreign campuses.

2. Computing

- a. **Inventory:** More than 76K digital devices owned by the University, ranging from tablets to servers, all of them connected to RedUNAM and the Internet
- b. **Supercomputing:** Fifth generation of supercomputers. Miztli cluster keeps running over 330 compute nodes, dual processor each node with 8 cores per processor, reaching more than cores, a hundred terabytes of RAM and 500 terabytes of fast access (12 Gbps) storage.
- c. **Other clusters:** ALICE cluster with 1024 cores and half petabyte of storage, acting as Tier-2 of the LHC @ CERN, plus a cluster of Power 7 and Power 5 processors capable of 600 cores.
- d. **Data Center:** 100 compute nodes, similar to those in the supercomputer, dedicated to the UNAM's private cloud, currently virtualizing more than 200 servers, capable of a ratio compression 15:1 and to keep over 500 terabytes of data in both SAN and NAS resources.
- e. **Software:** institutional licensing in several products, with an online store to download licenses, manuals and online training.
- f. **Visualization:** The largest scientific observatory for 3D immersion practices in virtual worlds

Current ICT trends and topics

In the discussions of this fiscal year at the CATIC, well known ICT trends have been adopted as part of the goals and guidelines to improve the computing and telecommunications in the University:

I. Cloud computing.

- a. **Public cloud:** Due the cost limitations on the broadband access in Mexico, and before any improvements that new federal regulations could bring into this topic, it is highly recommended to use public cloud services only on non-critical applications and services, such as information backup, social networking an personal non-private data.
- b. **Private cloud.** UNAM is making efforts to guarantee better local conditions for computing; storage and general IT services, as well as relevant investments have been made in local networks and the institution's backbone, reaching today from 10 to 40 Gbps in certain locations and conditions. Private cloud is recommended for critical and non-critical services under the umbrella of RedUNAM and UNAM DataCenter, whom are managed by DGTIC.

II. Mobile



- a. **Mobile devices.** These devices are undoubtedly more omnipresent in the University's campuses, situation that is putting more pressure on local resources such as WiFi Access and availability of power outlets for recharging. On mobile devices, hardware and software are responsibility of their respective owners or licensees. The institution could acquire these devices for several purposes such as investigations, education processes and administration tasks with no guarantee of service or stability unless a Mobile Device Manager is implemented in the local area.
- b. **Mobile networks.** RIU (The institutional WiFi Network) must be kept offered for free to every member of the UNAM's community (students, faculty, researchers, employees). There is no pre-established blockage to Internet use over the RIU service, and the access to local content must be enforced with help of technologies such as cache and proxy servers, reducing the impact in the broadband access.

III. Social networking

- a. **Applications.** Users inside the institution are responsible for the content they publish on the social networks and never could associate their opinions and other materials as an institutional point of view, keeping safe the institution from any third party claim. The time spent in the social networking is sole responsibility of the users. No pre-established limitations are set on the use of these types of applications.
- b. **Information:** UNAM could use materials and or contents authored by the members of its community with the respective approval. Likewise, members of the community could use UNAM's proprietary content under the regulations and allowances provided in each one of the archives, web pages or other sources published by the institution. UNAM will enforce that the usage of ICT resources and tools must be primarily oriented to fulfil the institutional objectives: to educate, to research and to promote the culture.

IV. High performance computing

- a. **Central supercomputing.** UNAM have set in operation the fifth generation of supercomputers since March 2013. Is recognised the relevance of supercomputing to reduce the expenses in general associated to scientific research, among many other advantages to improve the results of that research nation and worldwide. Provisioning of compute time in the supercomputer derives from the decisions at the core of the specialized multidisciplinary Supercomputing Academic Council, whom is responsible to call for projects, analyse their specific impact and goals and designate the resources from what is available. UNAM must increase the investments in this arena not only in terms of infrastructure, but specialized human resources training and graduate / postgraduate permanent development.
- b. **GRID computing.** Efforts must be increased for the collaboration in GRID projects. LANCAD (National Laboratory of High Performance



Computing) participation through the Metropolitan Delta Network – developed by UAM, CINVESTAV and UNAM- is mandatory. The sharing of software and hardware, as well as the continuous training for specialized GRID professionals must be reinforced by the collaboration in international projects such as ALICE (CERN – UNAM ICN DGTIC). A training facility and more research in GRID will be settled at the University to help the development of these professionals throughout the country and Latin American region.

V. Data analytics

- a. **Big data.** Computer science as well as scientific usage of ICT is the source basis for Big Data implementations in the institution. A central infrastructure to analyse structured and no structured data could help to improve continuous developments in all academic areas. New platforms for large amounts of data, besides the traditional databases, must be investigated, adopted and improved inside the University. Services as data crawling and local search engines, specialized in association of educational content as by-product of the academic archives and online production could be achieved, making a full integration of the regular institutional activities with the scientific advances.
- b. **Data science.** In the short term a strong necessity of professional and data scientist will appear not only for the university's purposes, but also as part of a new digital economy. UNAM must be ready to educate that type of human resources providing the test bed and operational infrastructure to accomplish their training.

VI. IT resources for education and cultural extension.

- a. **Hardware.** Usage of thin clients, where applicable, is recommended. Desktop virtualization must increase as far as improvements in local and wide area connectivity are implemented. X86 keeps as the traditional architecture, however new trends in technology opens the near future insertion of new platforms, such as GPU's, APU's and ARM (RISC)
- b. **Software:** Institutional licensing is recommended and soon will be mandatory. Those packages not available in the UNAM's software store could be purchased individually.
- c. **Networking:** Major investments are been made to improve connectivity to the Internet, also to provide better services locally, wired and wireless. Most of the campuses in the metropolitan area of Mexico City could be connected to the Metropolitan Delta and associated to NIBA (National Network for Broadband Access) y collaboration with CUDI, local and federal government.