

MASTER PLAN UNI - Managua

11th June 2002

1 Editorial notes

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1 Editorial notes

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2 Introduction

The UNI consists of two Campus ...

2.1 Policy Summary

2.2 Special note on Software Development and Deployment

It is noteworthy from the analysis of ICT projects of the other three Universities in Nicaragua as well as internationally, that very similar needs are expressed with respect to Software projects: Academic registry, Human resources, Library, Accounting.

With todays possibilities of information interchange and communication across country and continental boundaries it seems feasible, that a joint effort to achieve Software Applications that not only fullfill the individual universities needs, but even are inter-operable across the Internet would generate more sustainable programs with lesser cost for the individual project partners.

In fact, similar projects have had quite great success and approved development models, like Open Source and Free Software are available.

To foster collaboration and make a starting point, UNI adopts a firmly albeit tolerant position toward Free Software Development and Deployment.

The following are general guidelines, to be understood as UNI politics to-wards Software Projects to be contracted and to be developed in-house:

1. If a Free Software Solution exists for a certain problem domain it's acquisition, training and use is prioritised before similar or slightly better commercial solutions.
2. Economical savings out of reduced acquisition costs with respect to the lowest bidder of proprietary solutions are re-invested into improvement of the Free product or a lateral product like distribution, training, elaboration of manuals, translation or improvement of the software.
3. Participation of the faculties of computer sciences and systems in Free Software projects is incentivated economically.

2 Introduction

UNI installs typical implementation and collaboration tools like Savannah or the Sourceforge Systems in its computing facilities, to foster the creation of Free Software Projects.

4. Any externally or internally contracted Software production project will be produced and released under Free License terms.

Programmers which can not agree to work under a Free Licence paradigm can not be contracted by the University.

5. Production Tools, operating Systems and application software with Free Licenses will be made available via own distribution means to the university population at most at the production costs.
6. Free Software development and usage knowledge will be made available to the university population by means of their integration into the standard curriculae and open accessible courses.

3 Identified project needs

- Communication Infrastructure
Intranet , Campus Interconnection, Telephone and Teleconferencing Internet Connection, Communication Centres
- Human resource development
Training for: operators and administrators , end users, systems designers and implementors
- Academic Management
 - Online information systems: Academic records, Library, Financial Information, Human Resources,
 - Sistema de Inventario
 - Sistema de Gestion Docente
- Alternate education systems
Remote education, Online University, Multimedia Learning
- Academic publications
Online Libraries, Online Review Publishing, Monografic Database

3 Identified project needs

4 Implementation Fases of the Projects

4 Implementation Fases of the Projects

5 Project organisation

5 *Project organisation*

6 Communication Infrastructure

6.1 Intranet

6.1.1 Introduction

The actual computer inventory and networking capacity does not allow a general access of students and teacher of the University to computing and network resources on the campus. Actually there are 25 or more students per installed computer. The goal is to reach a level of one computer per 20 students and 1 computer per 3 teachers.

The network on the two campuses has been recently improved via fibre connections between different buildings, but there are still missing fibre routers and other connection and networking equipment to accomplish a real high efficiency campus backbone, as well as equipment and training of the human resources in charge of maintenance of the campus networks.

6.1.2 Goals

- Equipment, installation and connection to the Campus Backbone of student computer rooms in all faculties, to host a total of 450 PC's
- Installation and connection of 140 PC's in the departments to improve access of teachers to computing resources.
- Installation of two library computer rooms, one on each campus with a capacity of 50 PC's each, with access to virtual libraries and other research facilities.
- Installation of six computer facilities with 15 PC's each, in every faculty to provide access to virtual libraries and other research facilities.

6.1.3 Project components

RUSB

- Extension of the fibre red to add redundancy to the campus backbone and to reach more buildings.

6 *Communication Infrastructure*

- Substitution of the switches at the individual access points of the buildings by routers with filtering capabilities and fibre ports. Substitution of the actual fibre/Ethernet transceivers.
- Substitution of the Ethernet transceivers and distribution Switches at the CORC by a level 4 Router with fibre ports.
- Installation of 230 PC's in different locations of the campus, and their respective interconnection via Ethernet and to the Campus Backbone.
- Selection and acquisition of standard Software to use with the computers - operating system, networking applications and office suite. Installation of download mirrors, network installation. Provision of configuration, installation and user manuals in spanish, as well as distribution media. Training of faculty administrators in installation and configuration of the software.

RUPAP

- algo para la red - conexiones etc. - Paty - ayuda!
- Installation of 220 PC's in different locations of the campus and their respective interconnection via Ethernet and to the Campus Backbone.
- Contribution and adoption of the software to install at the computers in collaboration with RUSB.

6.1.4 Project organisation

OTIC - housed at RUSB is the organisational leader of the project. The executing departments at the two campuses are UNIREC at RUPAP and CORC at RUSB.

Global planning, coordination and acquisition of equipment, software and training is managed at OTIC by a to be formed project equipment.

Network installation at LAN level is contracted with local firms.

The project is subdivided into faculty and department level subprojects which are prioritised and executed at slow pace during the whole runtime of the ASDI project. Faculty administrators as well as students are involved constantly, so no additional personal has to be contracted and in-house capacities are trained.

6.1.5 Technological requirements

Ethernet LAN installation technology is used: Standard UTP cabling, Ethernet Hubs and Switches. Standard network operating systems and application.

Care has to be taken, that ergonomic and educative standards are met, which guarantee a high level of acceptance and identification of the end users with the installed equipment.

6.1.6 Activities

- Demand investigation with involvement of faculty administrators and end users.
- User driven priority of implementation sequence - most felt needs should be covered first.
- sub-project planning and preparation by OTIC/UNIRED/CORC staff.
- continuous implementation of sub-projects with a generic live cycle of:
 - preparation of physical infrastructure, involving electric and ergonomic conditioning.
 - Network cabling
 - Computer acquisition and installation
 - Software installation and network integration
 - Training of administrators
 - Integration into maintenance plans and network administration

6.1.7 Project Costs

Electric conditioning: $450 \times \text{US\$ } 30,- = 13500$, / 3 years = 4500/year

Physical conditioning (chairs, tables, rooms): $450 \times \text{US\$ } 60,- = 27000$ / 3 years = 9000/year

Computers: $450 \times \text{US\$ } 900,- = 405000$ / 3 years = 135000/year

Software, Training: $450 \times \text{US\$ } 30,- = 13500$, / 3 years = 4500/year

Note: the use of dumb terminals and terminal Servers, as well of Free Software Products can reduce initial and long term costs substantially:

Development Cost of a Linux Terminal-Server adaptation for UNI: US\$ 2000

4:1 relation between Terminals and Servers yields 300 Terminals and 150 Servers

Servers: $150 \times \text{US\$ } 900,- = 135000$

Terminals: $450 \times \text{US\$ } 300,- = 135000$

= US\$ 133000,- savings, not taken into account lack of License Cost because we assume that this funds will go into improvement and extension of the training program.

6.2 Campus Interconnection

6.2.1 Introduction

The faculties of the UNI reside on two campuses - RUSB and RUPAP. In the actuality each of them has it's own connection to Internet and its own ICT department CORC and UNINET respectively. There is no direct data connection between the two campuses which would allow to share resources and improve cooperation between them.

The two campuses maintain a great amount of independence and autonomy. While it is not intended to affect this situation, better communication media should improve collaboration and foster joint efforts in education and research.

It is also believed that system administration and maintenance could be simplified and costs reduced by this mean.

6.2.2 Goals

- Improvement of inter-campus and inter-department communication.
- Foundation of joint and interdisciplinary education and research projects
- Higher efficiency in external traffic consumption and in general Network administration
- Reduced ICT costs by standardisation of basic hard and software, as well as accompanying services like training, consulting and maintenance.

6.2.3 Project components

- Installation of a high speed inter campus link
- Unification of the two campus networks
- Configuration of shared resources between the campuses - File and Backup Servers, Mail Handling, etc.
- Creation of network services dedicated to inter-department and interdisciplinary research information exchange: bulletin boards, new-groups, Chat-servers, mailing lists, Workflow Software

6.2.4 Project organisation

OTIC at RUSB will coordinate the project with a dedicated project leader.

The creation of the basic communication infrastructure like the high-speed link as well as coordination of Hardware and Software Compatibility issues are addressed by a team formed by the applications and network department of UNIRED/RUPAP and CORC/RUSB respectively (first year).

Once achieved basic advances in the infrastructural components of the sub-project, the university council founds a project group with members of all faculties on both campuses dedicated to the development of procedures and proposals to foster the interdisciplinary use of network technology, by technological training as well as by the formation of social practises of interchange and collaboration. This project group is conformed in the first year with a long term perspective in mind and eventually is run as a sub-project group of OTIC, but with focus on social and personal impact of the use of TIC in favour of the phenomena of learning and research.

6.2.5 Technological requirements

- The connection can be accomplished either via a microwave or a fibre-optic link, being the latter the preferred method, because of easier integration in the UNI/RUSB campus backbone.
- One or two Servers and eventually special hardware for Backup or High Storage Volume solutions.
- Software for Collaborative work, research and education Training and Research in this Area is an important factor.

6.2.6 Activities

- Constitution of the “Hardware”-Team, between RUSB and RUPAP, with clear terms of goals and time-lines for the interconnection and homogenisation of the two networks.
- Acquisition of external contracts for installation of the communication equipment and information channels of the inter-campus link.
- Homogenisation and expansion of intra- and extra- network Services, consolidation of a co-organised administration and maintenance model for the UNI network.
- Formation of the interdisciplinary and inter-faculty research group.
- Implementation of software and server solutions as well as of the organizative proposals to improve intercommunication between departments and faculties independent of Campus.

6 Communication Infrastructure

6.2.7 Project Costs

Communication equipment and installation - high-speed link: US\$ 7000

Two Servers US\$ 4000,-

Training and development of inter-operation solutions: US\$ 5000,-

Organisational aspects interdisciplinary group, Software/Workflow/Training: US\$ 3000
× 3 years = 9000

6.3 Telephone and Teleconferencing

6.3.1 Introduction

The extension of the campuses' and the separation between them requires a proper inter-communication infrastructure to strengthen administrative and organisational efficiency. The actual telephony installations are obsolete and in desolate state, as well as they do not cover all the buildings. Integration of the analog telephone infrastructure with the digital red is desirable and in case of the inter-campus connection strongly recommendable.

UNI is involved in a variety of international academic cooperation efforts, where immediate communication is of invaluable help. A virtual conferencing room shall be installed on each campus, which allows interaction between our local researchers and foreign peers, as well as interaction on a national level between Universities and Institutions counting with similar equipment.

6.3.2 Goals

- Improvement of basic organisational and administrative efficiency by high availability of standard communication facilities
- Complete rehabilitation of the internal telephony network and expansion to cover both campuses, making obsolete the need to maintain numerous individual direct telephone line.
- The UNI wants to count with examples of most advanced communication equipment for video conferencing and voice over IP, for regular use and for educational purposes.

6.3.3 Project components

- Renovation of parts of the copper-based telephone network.

6.3 Telephone and Teleconferencing

- Installation of two fully automatic telephone plants, one on each campus. The plants have to be able to cooperate via the high-speed inter campus link.
- Acquisition of end-user equipment to connect all departments on both campuses to the telephone plants.
- Configuration of a department based cost accounting system for telephone communications.
- Installation of Voice over IP modules for both telephone plants. Voice over IP will have to sustain part of the campus wide telephone plant, and on the other hand reduce costs of overseas communication.
- Installation of a video conferencing equipment/room. This equipment will be available for intercontinental communication, educational purposes, but maybe could also alleviate costs of project coordination between the participating universities on a national level. There should be at least one equipment on each campus.

6.3.4 Project organisation

UNI will need at least one person dedicated to the maintenance of the telephone network, which would be contracted or defined at first. This person will be responsible for the development, design and implementation of the renovation of the telephone plants and networks, and will have sufficient training and knowledge to deal with modern telephony technology, like digital telephony and voice over IP. Parts of the installation will be subcontracted externally.

CORC will assume the technical and software application part of telephone accounting and voice over IP. Also the video conferencing infrastructure will be acquired, maintained and administrated by CORC. The equipment at RUSB will be maintained by UNIREC supervised by CORC.

6.3.5 Technological requirements

- Basic telephone installation
- Digital telephony
- Telephone accounting and programming and maintenance of advanced telephone plants.
- Voice over IP
- Videoconferencing/Multicast

6 Communication Infrastructure

6.3.6 Activities

- Election/hiring of the responsible for the telephone network.
- Planning fase, presentation of actual used technology, costs and implementation steps and timelines.
- Contract negotiation for acquisition and installation of equipment.
The Campus interconnection via internal telephony depends on the Campus Interconnection subproject.
- Acquisition of videoconferencing hardware
- Accommodation of physical infrastructure and installation.

6.3.7 Project Costs

Telephone plants: $2 \times \text{US\$ } 2000 = 4000$

Copper telephone Network: US\$ 5000

End User Telephone equipment: $300 \times \text{US\$ } 40,- = 1200$

Voice over IP - 2 modules + 25 handsets: US\$ 3000,-

Training Telephone maintenance/proclamation: US\$ 3000,-

Telephoner Accounting, Software and Integration: US\$ 5000,-

Videoconferencing: $2 \times \text{US\$ } 3000 = \text{US\$ } 6000,-$

6.4 Internet Connection

6.4.1 Introduction

The utility of the actual connection to the Internet is limited by narrow bandwidth and perturbed by frequent service disruptions. Redundant high speed connections to the Internet shall relieve this situation and at the same time maintain a low cost level. Different faculties and departments maintain their own connections via Cable Modem or even Dial-Up accounts to overcome the actual low availability of Internet Services. The resources bound by this inefficient approach shall be freed by an improved Service.

6.4.2 Goals

- Acquisition and maintenance of at least two central connection points per Campus to the Internet

- Redundant routing of traffic in a manner that guarantees 365×7×24 availability of Internet Services
- Load balancing and traffic control for improved efficiency of the available bandwidth to the End Users.

6.4.3 Project components

- Evaluation phase of existing offers with external consulting. Results: contracts with ISP's and Design of Network boundary infrastructure.
- Training of the Network administration department for installation, configuration and administration of the equipments, Software and techniques to be used.
- Acquisition of network equipment as well as infrastructural measures for housing and electrical and physical protection of it.

6.4.4 Project organisation

The director of CORC will be the leader of the project. He and the technician of the Network administration department will define first terms, receive the training and present the final project.

At least two students should be involved in the process by means of a monographic thesis, involving installation, documentation and administration.

6.4.5 Technological requirements

- Up to four routers with BGP and level 4 filtering capabilities
- Courses for the configuration of dynamic routing systems, traffic filtering and traffic analysis software.
- Electrical supply, conforming to the respective grounding and security norms, as well as availability

6.4.6 Activities

- Acquisition of training material, courses and one-to-one teaching with respect to the required knowledge.
- Selection of consultants.
- Demand analysis, taking into account both campuses and future increase of demand

6 *Communication Infrastructure*

- Analysis of the different of supporting fibers from ISP's, as well as alternative solutions with respect to long term costs and availability
- Development of redundancy, availability and load balancing strategies.
- Planification and acquisition of supporting infrastructure (Racks, Rooms, Antennas, Electricity, UPS).
- Evaluation and acquisition of equipment.
- Installation and configuration of equipment.
- Contracts with ISP's, connection and test of the configuration.
- Development of periodic administration, maintenance and report schedules and procedures.

6.4.7 Project Costs

- Training: 5000
- Consulting 3000
- Equipment: 4000
- Infrastructure: 150

6.5 Communication Centres

6.5.1 Introduction

Each campus counts with a dedicated department providing network administration, connection to the Internet and related Server administration - UNIREN at RUPAP and CORC at RUSB. However the capacity of this "Centres for Network Operation" is based on casual acquisition of equipment and won't sustain the increased load and demand of availability of the proposed expansion of use of information technology.

Not only

6.5.2 Goals

- Equipment, tools and installations for diagnosis, repair and preventive maintenance of computers and the LAN, fibre and Wan network.
- Server Farm for Software mirrors, encyclopedic databases and hosting of student, teachers and staff accounts.

6.5.3 Project components

RUSB-CORC

- Acquisition of a central high availability UPS system for the Server Farm and routers at CORC.
- Improvement or substitution of the air conditioning system.
- Training of the whole personal at CORC for their tasks in system administration
- Equipment and initial media stock for a campus wide backup solution.
- Additional computers from Servers for Application, Databases and Homing, to PC's and printers for the staff of the Computer Centre CORC.

RUPAP-UNIRED

- -no tengo ninguna idea de las necesidades

6.5.4 Project organisation

OTIC is responsible to thrive the development politics and to gather the demands and proposal from the student and research community.

CORC and UNIRED leaders form a team with the director of OTIC where this demands are regularly discussed on a technical and feasibility level. For each implementation decentralised solutions and centralised solutions (CORC) are considered with respect to organisational and economic constraints and opportunities.

The implementation of individual acquisitions or installations is then delegated to a subteam either on UNIRED, CORC or with a combined team of both departments.

6.5.5 Technological requirements

- Network and Unix technology.
- Servers, network equipment and support equipment like airconditioning, line conditioner and uninterruptable power supplies.
- Backup techniques and knowledge.

6 Communication Infrastructure

6.5.6 Activities

- Basic infrastructure in CORC:
UPS-Solution, Closed Mount Rack, Server Farm (two Servers), physical disclosure, repair of water leakage, Air-condition of the core equipment section at CORC
- Acquisition of a backup solution
- Expansion of fixed staff at CORC with at least one and a half person.
- Design and acquisition of a complete and redundant Server Farm.
- Development of end-user contact and information strategies and policies.
- Paty ! deci algo acerca de UNIRED

6.5.7 Project Costs

UPS - US\$ 5000,-

Acondicionamiento, aire y Mount Rack: US\$ 2000,-

Three Servers: two main servers and one load-balancing/control server: US\$ 6000,-

Backup via swappable high-capacity Hard disks: Server US 1400,- + 20 Disks, 80Gbyte
×US\$ 250 = 6400

7 Human resources development

7.1 Operator and administrator training

7.1.1 Introduction

With the increment of computing facilities and specifically the extensive use of networking techniques there is a mayor increase in demand of operation, configuration and administration knowledge.

Each of the six faculties will have to count with at least two persons actively involved in network maintenance and integration, and the computer rooms at the different locations, including the Library need supervisors and operators.

The network operation centres at both campuses will be equipped with teams of two to four operators and administrators, who will need extensive training in Windows 9x/ME/XPE and Windows NT/2000 in networked environments, as well as backup strategies and techniques and Unix System administration and network security.

7.1.2 Goals

- Both computing centres (UNIRED and CORC) count with highly trained personal for the continuous maintenance of the UNI network(s) and for the development of solutions to the continuous evolving demands of ICT.
- All faculties count with trained operators and administrators, capable of maintaining the availability of the computing facilities installed, as well as take part in expansion projects.
- Other facilities, like the Libraries computer rooms which are open for the public count with operators and administrators, which can guarantee their availability for the student and research population of the UNI.

7.1.3 Project components

- One administrator of each campus will be scheduled to training as a Certified Microsoft Engineer. Each of the variants of Microsoft's Operation systems have

7 *Human resources development*

to be part of the complete training plan, which can be complemented by other courses.

- All administrators and operators of the university receive a training which enables them as operators of Linux and Sun's Solaris operating system.
- At least two of the administrators of each network centre receive a complete training program as system and network administrators for Linux.
- To guarantee continuous education, the training department of CORC has to be consolidated, equipped with educational material and funds to generate own trainings programs at least up to operators level on the Unix systems and Network configuration on Microsoft systems, as well as to catch up with national acquirable courses and training opportunities.

7.1.4 **Project organisation**

OTIC will conform the training department of CORC contracting at least one person half time. The funds for salary and working material for the first three years shall be acquired via the ICT project, time span within which the impact on the universities population is measured and the task is either taken over by other university institutions (Faculty of computer science, for example), or the department is consolidated and financing taken over by the University.

Care will be taken, to make the training material and experiences available to the whole University community in form of educational material, programs and accompanying reports and evaluation.

The training department is responsible for the selection and scheduling of the training program of the operators and administrators of the network and the public computer facilities.

7.1.5 **Technological requirements**

- Office equipment and furniture, including Computer with multimedia and publishing capabilities. Connection to the campus network
- Access to training facilities on the Campuses, especially to computer training centres, to be able to organise the courses.

7.1.6 **Activities**

- Constitution of the training department, supervised by the director of OTIC
- Elaboration and implementation of short and medium term training programs for the OTIC staff, as well as for the faculty and public computing facility staff.

- Organisation of off-site training opportunities for selected personnel.
- Elaboration of proposals for long term and continuous education models for ICT on the University for the ICT personal
- Assessment of End User Training by assistance to the respective sub-project
- Continuous advance reports and evaluation of the project.
- Generation of a Library of training methods and materials specialised for the need of the network and system administration.

7.1.7 Project Costs

Office equipment and conditioning: US\$ 2500

Salary for training department: US\$ 1000 × 12 months × 3 years = 36000,-

Fonds for specialised training: 4 persons × US\$ 1500 × 3 years = 18000

Fonds for educational material and local courses: 12 persons × 3 courses × 3 years × US\$ 300 = 32400

7.2 End user training

7.2.1 Introduction

The primary target group of the whole ICT project are the end user with the goal to habituate them to be able to integrate information and communication technologies into their every day routine.

The whole technical infrastructure is of no end, if the users cannot access to them with ease and skill. This is not only valid for basic thrills like tip-typing or mouse handling, but also for the use of Email, mailing lists, search tools etc. and for meta information like Netiquette and Jargon.

Even the lack of English language skill form a big obstacle to plain use of ICT infrastructure.

All of this leads to the conclusion, that end user training has to be assessed in a systematic and massive approach, if ICT is meant to unleash innovation and make technological development based on today's global standards a reality in our University.

The End user training sub-project is perceived as twofold - exploration of educational models adapted to the specific knowledge, economic and environmental conditions we find in our students, teachers and researcher population, as well as an initial and massive shock-wave upgrade of knowledge.

7 *Human resources development*

The university counts with capacity in educational science as well as computational science, so there should exist auto-sufficiency for the development and implementation of the programs and schedule to be developed. However, a dedicated project has to be formed to base end user training on a systematic and sustainable approach, both in methodological as in economic terms.

So the sub-project, by providing external funds for massive training also provides opportunities of learning and research for the very own university teachers which have to be involved as far as possible. In cooperation with the training department of OTIC close supervision and evaluation, as well as gathering of research and educational material has to be accomplished.

7.2.2 **Goals**

- During the three years of the project, the whole student population will be covered with basic computer courses up to Word processing, electronic presentations (slides) use of Email and elaboration of Web-pages.
- In the third year, this courses have reached maturity and are only to be offered as regular courses for new students.
- All university teachers are trained in the same skill, and additionally have receipt courses in electronic publication and elaboration of multimedia and interactive educational material.
- All administrative and auxiliary personal of the university has receipt training in basic computer skills, up to word processing, use of Web-based interfaces and correspondence by Email.
- All trained users have additionally acquired knowledge about basic maintenance and handling norms, as well as environmental conditioning and econometrics required for sustainable use and care of computers.
- The University has encountered an organisational form to deal with continuous formation of these skills for students as part of the standard curriculae, as well as to cover continuous training of new personal.
- A study about the projects goals and contents has been elaborated, indicating impact, success and efficiency. The study has to give insight about the global improvement in scientific communication, research and education.

7.2.3 **Project components**

An interdisciplinary research and planning group has to be established, composed of members of the educational sciences, computer science, university management and the training department of the CORC.

Each faculty provides support and integration of its ICT training activities via the delegated ICT member, and eventually additionally assigned personal. Close feedback and cooperation with the operators and administrators is required, as they are closest to the end users outside of the courses.

On each campus one or two public accessible computer facilities are rehabilitated especially for the basic computer training to students and personal.

To cover the initial increased training demand, in the first year a group of students is selected and involved actively in the training activities.

7.2.4 Project organisation

The Vice-rector for research establishes and coordinates the research group, involving OTIC's training department and the administrative area. One member of the group is named long term coordinator for the accompanying research and evaluation, and is responsible for the scientific organisation of data acquisition as well as analysis and presentation.

Each faculty determines and communicates training needs. Courses are organised as close as possible to the faculty and shall be integrated in the normal course scheduling of the faculty.

Training of teachers and administrative personal is organised and scheduled in coordination with OTIC's training department, by contracted trainers. A small training facility has to be created and equipped, with about 10 computers, this facility is designated to OTIC.

7.2.5 Technological requirements

- Habilitation of four computer facilities for student training.
- Conditioning and equipment of OTIC's training facility
- Equipment and material for the research and evaluation component.

7.2.6 Activities

- Consolidation of the research and planning group
- Acquisition, equipment and basic training material (different Operating Systems and Applications) of OTIC's training facility.
- Selection and training of the auxiliary training team.
- Planning of research data acquisition and first training approaches, constraints and policies.

7 *Human resources development*

- Coordination and Scheduling of regular training in the faculties.
- Coordination and Scheduling of training of administrative staff.
- Periodic evaluation and research data processing and presentation, culminating in a final Research paper.
- Systematic recollection and preparation of training material and corresponding publication and distribution to the faculties.
- Final long term planning and proposal to the university, taking into account the result of the research component.

7.2.7 Project Costs

Salaries of extra trainers: $4 \text{ students} \times 12 \text{ events} \times \text{US\$ } 400 \times 2 \text{ years} = 38400$

Subsidiaries, material and equipment to research and evaluation component: $3 \times \text{US\$ } 3000 = 9000$

Training facility for OTIC: $10 \text{ PC's} + \text{Network} + \text{Software} + \text{conditioning} = 10 \times (900+30+500+50) = 14800$

Publication of training material: $3 \times \text{US\$ } 3000 = 9000$

7.3 Systems designers and implementors training

7.3.1 Introduction

The adoption and implementation of a variety of software applications for administration and research is foreseen in the near and medium future. While traditional Software engineering indicates the building of one or more core programmer teams with a complete analysis, design and implementation cycle, the new approaches to Software application building are more open and leave more space for individual motivation and partial contribution. One of the greatest challenges of open projects is the formation of a large user and contributor base.

On the other hand, in Nicaragua Software production is intently coupled to proprietary development tools, used to create proprietary software on proprietary operating systems only: MS-Access, Visual-Basic, etc. The enormous toolbox of Unix and Open Software development is largely unknown, less understood.

To boost the understanding of modern software engineering and give basic tool knowledge to the biggest possible audience it is necessary to implement a training program which opens the opportunities of more accessible and robust software to the University.

7.3 *Systems designers and implementors training*

Teachers of the computer Science faculty will receive exhaust learning chances giving them the medium and ability to apply them in the educational process. Open courses at low cost to the general public have to be offered and a sufficient number of public accessible computing facilities with preconfigured development tools have to be offered.

As a side effect, this approach should also soon lead to improved Software production techniques outside of the University, as graduated students integrate themselves into the production process and business world.

7.3.2 **Goals**

- All teachers of computer sciences and similar careers have basic knowledge about the technological offers and organisational implications of Open/Free Software Development
- All teachers of Software Engineering and programming languages are familiar with Open Source/Free Software development tools and apply them systematically (but not exclusively) in their courses.
- All students of careers affine to Computer Sciences are put into contact with Open/Free Software and its production means.
- Any students desiring so has the opportunity to use Open/Free Software for learning, research and the monografic thesis.
- Broad contribution amongst ICT staff, teachers and students is achieved for all Open/Free Software development projects of the ICT project.
- The Software Application programming sub-projects are capable of exploiting Free Software techniques and tools wherever it seems appropriate to the process.

7.3.3 **Project components**

Intensive courses in the use of Free Software and programming tools for teachers and ICT staff of the Application Software groups are held.

It is desirable to invite major figures of the Free Software movement, preferably from Latin America and Spain for speeches and Workshops.

Involved faculties obtain relevant knowledge and re-program the curriculae of the respective careers to include Free Software production tools and techniques.

OTIC's subdepartments CORC, UNIRED and the Software Application Group acquire, prepare and install relevant Software and redistribution packages and Media for a homogeneous use and availability of the tools.

Two core programmer teams are formed on each Campus, to coordinate the dedicated Software development sub-projects. These teams receive special training in Software

7 *Human resources development*

Engineering to be able to integrate the devised solution into the organisational structure of UNI.

7.3.4 **Project organisation**

For one part, OTIC's Software Application departments assumes selection acquisition, and maintenance of Free Software Tools and Applications and it's redistribution means and methods for the whole University, along with proprietary systems.

Training at subsidised costs is offered in coordination with OTIC's training department.

On the other hand, the computer science faculty assumes the role of introducing Free Software techniques and tools into it's plans and activities.

The faculties also assume the specialised training for teachers and programmers, actively supported by the trainings department of OTIC.

7.3.5 **Technological requirements**

No special Hard- or Software requirements are necessary for the implementation of this sub-projects, despite of Disk Space, distribution media etc.

7.3.6 **Activities**

- Acquisition of courses for university teachers and programmers about individual software development tools, and general concepts of Free Software Engineering, as well as Software and System Design and implementation.
- Design of training courses for Free Software design and implementation, which will be offered to the general public.
- Organisation of speeches and workshops with renowned Free Software programmers and thinkers.
- Coordination of all careers which involve computer programming to introduce contents with respect to Free Software in the curriculae
- Selection, acquisition and preparation of redistribution means and methods for Free Software Components.
- Installation of Free Software operating systems, applications and development tools in at least a 50% of public computer facilities.

7.3 Systems designers and implementors training

7.3.7 Project Costs

Courses: 20 persons \times 4 courses \times US\$ 400,- = 32000

5 speeches/workshops in three years \times US\$ 5000,- = 25000

Media for redistribution: US\$ 2000

7 *Human resources development*

8 Academic Management

8.1 Introduction

As stated in the general politics, Free Software techniques are considered a key factor in the success of the to be executed Application Software sub-projects described in the following sections.

The general principles applying to all of them can be resumed as following:

- Every Software product created in the process is not only available to UNI, but to anyone who wishes to use it
- Existing Free Software product are considered as prioritised solutions and/or starting points for our own application.
- It is desired and actively supported, to have a large contributing community. Our Application Software programmers understand themselves as coordinations and facilitators rather than as the only knowledgeable specialist in the matter.
- Early and intensive involvement of the end users and their ICT-confidants is allowed, desired and actively promoted.

Based on the experience, that end-user computer skills, their understanding of the processes they manage or the tasks they execute, and their involvement in design and implementation are crucial for the success and acceptance of software solutions, decentralised and distributed components which resolve felt needs are first to be developed. These can be as simple as sets of document templates and specialised spreadsheets. Care has to be taken, that interoperability on operating system level, application program level, network level and data interchange level is guaranteed, and that Licenses allow redistribution and modification of the found approaches.

Big applications, like datahouses, data browsers and consolidation computing preferably take off from input contributed by the decentralised “client” applications.

Interoperability is achieved by preferring existing, well know protocols and standards, over housemade solution, e.g. Web-based clients, SQL-compliant databases, XML-based data interchange formats. TCP/IP based network connections.

8 Academic Management

The next sections point out a general approach applicable to all Application Software Sub-Projects, unless otherwise stated or complemented by individual remarks in the respective Sub-Project's section. The Sub-Project's sections only will contain the individual information respective to their nature.

8.1.1 Application Software Project Organisation

A project steering team has to be constituted for each Software project, with two crucial roles to be fulfilled by adequately selected persons

- Organisational Management

This role preferably has to be taken over by a person, working in the target area or group for which the application(s) are to be developed. His/her role is the coordination of knowledge rising about the problem domain and the broad involvement of the end-users in all fases of the Software development cycle. The taker is preferably a knowledgeable, experienced person from the top management of the involved area.

- Technical Management

This role is taken either by a contracted senior programmer, or by a member of the inhouse application software department of CORC. It is also allowable that a teacher or researcher from the computer science department takes this role, if it seems appropriate with respect to the necessary time involvement. The role has to coordinate the programming tasks and supervise and lead design and implementation decisions. It is also responsible for release management and timelineing.

It should be underlined here, that the key programming tasks, methods and skill do not differ from traditional and well approved software engineering methods. Analysis, design and documentation has to follow the respective standards and quality requirements. Outsourcing of tasks is possible and desirable if the respective criteria are met, and if external partners can be found, that fit into the general organisational outlines presented here.

The Software Projects to be developed use standard Open/Free Software tools for concurrent version control and redistribution. A tool like Savannah or Sourceforge has to be installed, where all Projects and Subprojects store and communicate their achievements. This systems include Software repository, Project Web pages, Project accounts, Mailing List management, and others features. It is believed, that a common infrastructure to application development eases interproject cooperation and interoperability between the encountered software solution.

8.1.2 Application Software Technological requirements

Instead of installing individual database and application servers a scalable server farm dedicated to the academic management will be installed. Main components will be

- a professional database management system like PostgreSQL, capable of access control, large scaling, replication and database backup ease.
- Webserver with a variety of application support like php, php-groupware, Zope, and a fine-grained robust authentication system, as well as secure socket layer support.
- Security and privacy Software: intrusion detection, encryption software, VPN capability, etc.
- Availability and Backup facility - independent UPS, RAID 5 (at least), remote backup server, etc.
- Implementation servers, with similar functionality, but less access and security restriction, used for off-production development of the applications.
- User authentication system: magnetic-strip-card, chip-card, or similar system to provide students, visitors and staff with electronic/visual authentication media to the services to be provided. Includes card-printers/burners, card-writers and card-reader terminals, as well as the respective software.

Project managers need training to specialise in the used tools and techniques as well as to learn about software development project management, in the case of the organisational managers, which will be selected rather as coming from the problem domain, rather than because of computer science background.

Provisions for extra training or research opportunities will be made, so project managers or core programmers can obtain and test available software, visit sites with similar projects, opt for specialised courses etc. This item is taken care of partially within the human resources development sub-project.

The required communication infrastructure will be provided by the CORC systems team and the Universities Server Farm (Software repository, user accounts, mailing lists, etc.).

8.1.3 Application Software general costs

Server Farm:

4 + 1 servers for production and development: US\$ 10000

routers, network, ups system, conditioning of infrastructure: US\$ 35000

strip-card/chip-card system: US 150.000

Additional training and research funds: US\$ 3000 ×3 = US\$ 9000

8.1.4 Parallel Software Projects

It is well known, that the four nicaraguan Universities involved in the ICT projects have very similar needs with respect to the individual software solutions. It is also well known, that other universities in similar conditions, like La Paz/Bolivia, Makerere are approaching parallel projects at this time.

We consider duplication of efforts a waste of time and valuable resources and will try to coordinate forces with these other projects.

In the following described application software sub-projects, which coincide not surprisingly with other universities needs, we use the Makerere's findings and preliminary analysis as a basis. Their documents can be found at <http://www.makerer.ac.ug/makict/documents/policydoc/> with individual links shown in our respective sections. In this document we just give a resumed view of what can be found there. The UNI approach however is slightly different because of the decentralised end-user-bottom-up-habilitation envisioned. Because of this approach a detailed description of the required functionality is not to be available before the first step - user involvement. The general analysis however is seen as stringent guidelines, giving the direction of the individual projects.

8.1.5 Just for fun and enlightenment -

- and for explanation.

Eric Steven Raymond has provided us with essential insights about the Free Software development processes, find here the extract of his thesis of the paper "The Cathedral and the Bazaar":

1. Every good work of software starts by scratching a developer's personal itch.
2. Good programmers know what to write. Great ones know what to rewrite (and reuse).
3. "Plan to throw one away; you will, anyhow." (Fred Brooks, "The Mythical Man-Month", Chapter 11)
4. If you have the right attitude, interesting problems will find you.
5. When you lose interest in a program, your last duty to it is to hand it off to a competent successor.
6. Treating your users as co-developers is your least-hassle route to rapid code improvement and effective debugging.
7. Release early. Release often. And listen to your customers.
8. Given a large enough beta-tester and co-developer base, almost every problem will be characterised quickly and the fix obvious to someone.

9. Smart data structures and dumb code works a lot better than the other way around.
10. If you treat your beta-testers as if they're your most valuable resource, they will respond by becoming your most valuable resource.
11. The next best thing to having good ideas is recognising good ideas from your users. Sometimes the latter is better.
12. Often, the most striking and innovative solutions come from realising that your concept of the problem was wrong.
13. "Perfection (in design) is achieved not when there is nothing more to add, but rather when there is nothing more to take away."
14. Any tool should be useful in the expected way, but a truly great tool lends itself to uses you never expected.
15. When writing gateway software of any kind, take pains to disturb the data stream as little as possible – and **never** throw away information unless the recipient forces you to!
16. When your language is nowhere near Turing-complete, syntactic sugar can be your friend.
17. A security system is only as secure as its secret. Beware of pseudo-secrets.
18. To solve an interesting problem, start by finding a problem that is interesting to you.
19. Provided the development coordinator has a medium at least as good as the Internet, and knows how to lead without coercion, many heads are inevitably better than one.

Note: items 15 to 17 are rather technical then conceptual.

8.2 Academic records

8.2.1 Introduction

Global availability data about students identities, their enrolment, admission, registration, transfer, graduation, payment status, etc. is a key requirement for efficient administration, because of its impact on all university entities: Senate, Colleges, Faculties, Departments, Student Services, Finance departments, etc.

The Academic records systems (see also ARIS, <http://www.makerere.ac.ug/makict/documents/policydoc/annex1/aris>) is conceived to improve availability, accuracy and speed of access on all levels to this data.

8 Academic Management

A submodule mentioned in the ARIS analysis is the course registration and class scheduling system.

It should be noted here, that this submodule overlaps with a not-mentioned area worth of providing with ICT recourses - maintenance and infrastructure. At UNI a thesis is actually being development which implements a maintenance workflow system for equipment maintenance, based on free software components. Infrastructural planning and maintenance could well be worth a subsequent step and ARIS should scale to it.

8.2.2 Goals

- Creation and modification of computerised records about students enrolment, movement, payings, degrees, notes, etc. are realised at the place of creation of the respective data.
- Access to required student data at a specific workplace is possible via the desktop computer at the location and at the moment required.
- Privacy and Security of Student data is assured by an appropriate policy and by organisational and computational means to make the system comply to it.
- Resource planning and scheduling with respect to: courses, teachers, classrooms and media are aided by a respective planning sub-module.

8.2.3 Project components

A long term project team shall be established, which tackles all aspects of improvement and automation of academic registry. This team is part of and supported by the politics outlined in the last ten year plan of the UNI.

Privacy and security policies for the handling of personal data will be elaborated and made part of the official rules of UNI.

A student database will be envisioned and developed, with primary use for the academic registry.

A database access facility for the Faculties will be provided, easing the access to relevant student data for all faculty staff members according to their function.

Other components will be added either by acquisition or development, according to most felt needs and priorities.

8.2.4 Project organisation

A UNI top management member, preferably from the academic registry, will assume the role of project leader, to which one member of the CORC's Software application department will be associated as technical manager.

The teams sticks to the guidelines laid out in “Directrices, Metas y Presupuesto 2001”, and it’s follow up documents, as well as to the outlined politics in the ICT project.

Additional engineering resources are assigned or hired according to the momentary needs of the sub-project.

8.2.5 Project Costs

About 10 Workstations/Terminals for end-users US\$ 5000,-

External functional and managerial support: US\$ 50000,-

8.3 Library

8.3.1 Introduction

As before, similarity is found to the project outlined in <http://www.makerere.ac.ug/makict/documents/policydoc/ann>

However in the latin-american context adherence to the well known and widely used Micro-ISIS and the support provided by Bireme/Brazil is heavily advised in contrast to a “home-made” solution.

The focus of the project is to be found in evaluating weaknesses in the Micro-ISIS’ Software and Organisational Solution, and contribute by closing gaps and by assistance to a nation- and continent-wide integration and interchange of bibliographic data and technology. Eventually interoperable products have to be envisioned.

Value should be added to the actual library services, by integrating faculty and department/institute libraries into a global cataloguing system, as well as promoting use of the library and associated services in research and education.

The actual tendency toward free available resources (see MIT’s publication project) shall be assessed both by providing resources to the INTERNET (see other sub-projects) and by acquiring access and promote use of the public libraries and information sources. A search engine and database with focus on spanish literature and papers shall be installed and maintained and promoted as preferred information source among the academic community in Nicaragua. The public computer facilities of the library are to be expanded, component which is outlined in the communication infrastructure sub-project.

8.3.2 Goals

- automation of the loan system of the library with use of electronic authentication media in combination with the students database.

8 Academic Management

- MicroISIS library system is fully functioning and interchange to other universities as well as organisations of the public and non-governmental sector in Nicaragua and Latin America is done on a regular basis.
- Teachers use and promote the library services and recourses in research and education.
- Use of remote search engines are widely substituted by the own knowledge lookup database.
- The library is equipped with extensive public computer facilities (terminals) for individual use, meeting regular demands of use.
- Regular courses to the university public in the use of the library services are organised. They form part of the standard curriculae of the students.

8.3.3 Project organisation

Project leadership is taken over by the library personnel in first place. Preferably external resources should be hired to provide installation and training of MicroISIS, this training should preferably coordinated or shared with national institutions involved in library activities like documentation centres and special interest groups, as well as the national association of libraries.

For the expanding of the local computing infrastructure of the library and the search database, contact with CORC's Network and Software Application department will be sustained.

8.3.4 Technological requirements

- Server for Bibliographic database, plus networking and availability Infrastructure (UPS, Air Conditioning, grounding)
- MicroISIS
- Server for search machine and database, Software
- Training for library staff and end-users.

8.3.5 Project Costs

Acquisition, training, installation, maintenance and distribution of MicroISIS: US\$ 3000,-

External Contracts: US\$ 25000

Two Servers: US\$ 4000,-

UPS and Network Infrastructure for Library Server: US\$ 1500,-

Acquisition, Subscription Costs to information services, etc. for the search machine and database: US\$ 3500,-

Additional training and research fund for library staff to know and participate in meetings, talk, workshop about online library management: US\$ 4500,-

8.4 Financial Information System

8.4.1 Introduction

The respective section in the Makerere Document is

<http://www.makerere.ac.ug/makict/documents/policydoc/annex1/finis.htm>

the to be implemented system is called “FINIS”:

“Financial management of the university encompasses a number of closely related administrative and managerial processes. These processes involve monitoring and analysing the university’s financial conditions, general and special account management, budgeting procedures, preparing financial statements and reports, payroll/income tax calculation and salary payments, and managing cash flow.”

At UNI, financial information and improvement of the managerial and administrative procedures is part of the existing mid term strategic plans. The “FINIS” project will integrate into the efforts made at institutional level.

At present the implementation method is not decided. On one hand the creation of a financial information systems is a very specialised task and there are commercial solutions, both free and proprietary available. On the other hand, it is known that the organisational structure of the UNI is sufficiently sophisticated to break any existing standard accounting package. Public and private education forms, assessment of multicurrency external cooperation projects as well as a wealth of different course type: standard, post-graduate and long distance courses, with different payment methods and certifications, plant lecturers, contracted and guest lecturer, etc. etc. are a real challenge for integration into one system.

8.4.2 Goals

- Major administrative cost factors, within the findings of an organisational improvement phase, are analysed and alternative solutions encountered. Wherever adequate, supporting computational systems will be acquired or developed.
- The personal authentication system (chip-card/strip-card) is used as a common medium for registration of accounting data at the point of incident. The resulting data merges neatly into the general accounting system.

8 Academic Management

- Economics and involvement indicators common to universities, are defined and extracted directly from the accounting and financial information system by pre-defined report mechanisms. Additional reports can be defined easily by trained inhouse personal, preferably at the administrative departments themselves, otherwise at CORC's application software department.
- Short term project management and financing/accounting integrates into the financial registration, processing and information system. Support for planning, and acquisition fase is integrated into the system, as well as budget planning.

8.4.3 Project organisation

The institution level team assigned with the re-engineering of administrative procedures is supported by one dedicated person at CORC's software application development department. The role of this person is not precisely implementation of software, but rather research assistance and coordination of corresponding sub-projects.

8.4.4 Technological requirements

- Application Server Farm
- Authenticating System (Strip-Card/Chip-Card)
- Upgrade of computer equipment and conditioning (Grounding, uninterruptable power supply, air-condition, etc).

8.4.5 Project Costs

Software implementation and introduction costs: US\$ 250000,-

15 Computers: US\$ 13500

10 printers, including special equipment for Strip-Cards, anonymous forms etc. US\$ 2500,-

Conditioning of facilities: US\$ 7500,-

Note: Makerers calculus assigns less resources to the financial system then to the library system. This does not seem feasible to us, as the latter is much more standardised and instant applicable systems are available, while any financial software is bound to have great introduction and adaptation costs.

8.5 Human Resources

8.5.1 Introduction

The human resource information system, boils down to a personnel data base with connection to other administrative systems like academic registry (course planification), financial/accounting system (payroll), and some extension, like training planification, staff evaluation, recruitment and discharge.

“A Human Resource Information System and Payroll Information System encompass a number of closely related processes supportive to human resource management. In particular they include maintenance of employee records, the quantitative and qualitative forecasting of capacity, allocation of human capacity, the calculation of salaries and, in accordance with established policies and procedures, the provision of management information. ...”

<http://www makerere.ac.ug/makict/document/policydoc/annes1/huris.htm>

The human resources system can be seen almost as a sub-component of the financial information system, however is considered as prioritised because of its immediate impact on resource assignation, and the overlapping function between academic registry and payroll system.

8.5.2 Goals

- A comprehensive electronic database system complements paper-based files about all university staff. Replaceable functions of the current systems are substituted complete by the computer system.
- Course planning and academic registry is supported by the staff database
- Payroll functions of the accounting systems are supported by the human resources database with data about contract time, extra hours, absences, vacations, etc.
- Human resource planning functions for academic and non academic areas of the university are supported by the human resource system.
- Privacy and Security of the registered data is assured by both, a policy document, validated by the university council as well as the corresponding computational security means.

8.5.3 Project organisation

The human resources department forms a project team together with academic registry and the accounting department, to define the data registry approach and reach, as well as for preparing proposals to the privacy document.

8.5.4 Technological requirements

- Application Server Farm
- Authentication System (Chip-Card, Strip-Card)
- Upgrade of computer equipment, as well as conditioning for the expanded needs of availability.

8.5.5 Project Costs

Software implementation and introduction costs: US\$ 35000,-

10 Computers: US\$ 9000,-

5 Printers: US\$ 1000,-

Network update, environment conditioning: US\$ 2500,-

9 Alternate Education

9.1 Remote education

9.1.1 Introduction

Education by distance is a yet practiced form of knowledge transfer at UNI, albeit severe drawbacks, like deficient public transport means, telephone communication and postal connections, hinder a broad application.

The ICT project can be valuable by using Internet communication for announcement, subscription, lecturers/participants communication, etc. and thus providing faster and cheaper means for the UNI to accomplish information, divulgation and distribution of teaching material.

Some computational infrastructure will have to be created, as well as accomodation of standard office automation packages and communication software. Participating teachers will need access to computers to communicate with the course participants as well as training in the use of the ICT media. The same applies to administrative staff of the education by distance department.

9.1.2 Goals

- The department for distance education counts with its own webpage and uses it for publication, advertising and subscription of course participants.
- Participants benefit from the ability to send their practice papers and exams in via Email.
- Divulgation, Correspondence and Publication costs are reduced by the application of modern ICT.

9.1.3 Project components

- A Server (virtual server) for the distance education department is configured
- Courses from basic computer use to Web-design and Networked communication techniques, Mailing lists administration, etc. for teachers and administrative staff.

9 Alternate Education

- Computer infrastructure at the distance education department is upgraded, extended and configured to comply with the given needs.

9.1.4 Project organisation

The leader of the distant education course is responsible for project formulation and management. An external consultant in Website design is contracted to aid in the initial lay out of the Web-Site, including registration, subscription, info contact address, etc.

Training of the administrative staff as well as the involved teachers is coordinated with the Human resource development project.

9.1.5 Technological requirements

- Web/Database server.
- Dynamic Web site design.
- Mail server and mailing list server
- Terminal workstation, printers for the administrative staff, as well as terminals for the teachers and lecturers that cannot count with their own Internet connection elsewhere.

9.1.6 Project Costs

1 Server: US\$ 1800

External consulting, programm/site development: US\$ 4000

7 Staff/Teachers terminals + Printers: US\$ 7000,-

9.2 Online University

9.2.1 Introduction

Since about four years several efforts, mainly parting from the Faculty for Electricity and Computing, have been made, to get UNI online. A complete set of courses and careers are planned, partly in parallel with the traditional careers offered by UNI, partly as free courses.

The habilitation of the online university UOL has been delayed to synchronize with the ICT project and its improved internet connections and supporting ICT infrastructure.

UOL counts with its own server, homed at CORC, where the corresponding Software has to be developed and tested.

One major requirement for a broad accessibility to this particular form of education is the e-readiness of the country. The UOL projects aims to coordinate with regional internet service providers/Internet Cafés at remote cities, to enable participación in the courses on a nacional level. A project to integrate packet radio technology to reach even remote rural areas is also forseen.

UOL stands not alone in Central America, efforts are also coordinated with Costa Rican and Guatemaltekean Universities.

9.2.2 Goals

- Creation of a complete virtual university, to match and mix with traditional education models
- Extension of reachability of the university to remote areas of the country

9.2.3 Project components

- Local Equipment: Computers for the staff and contributors to UOL, equipped for design of the courses.
- Software Development for Web-Site publication, registration of lecturers and participants, course scheduling, on-line exams, and redistribution of educational material.
- Conexión project: Travel expenses for contact exploration and support of remote access sites.
- Rural remote connection: equipment for two experimental Packet Radio end-point stations and development of course techniques adapted to the respective low bandwidth conditions.
- Human resources: Lecturers have to be trained to be able to create their “virtual” educational material, and to interact remotely with students and course participants. This componente coordinates with the global human resources sub-project.

9.2.4 Project organisation

The institute which is actually leading research in this area will be the stakeholder of the project. Expansion of the team is desirable. CORC will contribute manpower to help resolve technical aspects like conectivity, software selection and installation, as well as house the Servers en required communication equipment.

9.2.5 Technological requirements

- Multimedia habilitated equipment
- Course building Software
- Web/Mail/Mailing-list/Database Server for the UOL Software
- Organisational means for recruitment of teachers as well as students and participants subscription and attention.
- Packet Radio and repeater equipment, as well as a dedicated Server for RP-routing to the Internet.

9.2.6 Activities

- Actualization of computing equipment of the FEC-institute.
- External contract for the UOL Software
- Development of courses
- Remote contact exploration
- Experimental rural extension by Radio Packet. Creation of a feasible model.

9.2.7 Project Costs

4 Computadoras: US\$ 4000,-

Scanner, Printer: US\$ 2000,-

External Consulting for Web-Site programming: US\$20000,-

Server, Radio Packet Equipment, Private Radio Band, 10 remote stations: US\$ 45000

Travel expenses for regional contact exploration: US\$ 5000

Additional specialized courses, participation at international Meetings and Workshop: US\$ 15000

9.3 Computer based and Multimedia Learning

9.3.1 Introduction

Modern computer technology gives access to new forms of knowledge presentation and transmission. Interacción to computer programmes is not any more restricted to mere tip-typing, there are more sensorial feedback methods available, capable of accessing more

9.3 Computer based and Multimedia Learning

senses. Role based games and networked player interaction, as well as virtual reality modelling can give attracting and fascinating learning inputs. Today's computing power of standard workstations as well as available high level software allows development of multimedia learning material at a reachable cost to producers and consumers.

The multimedia learning project gathers means and knowledge at UNI to put into practice this valuable tools and methods both at research and at real world application level.

A primary goal is, to make multimedia, computer based and networked learning accessible to a broad range of users, i.e. maximum exploitation of low-cost and standard hardware, as well as selection of best-efficient Human Interfaces.

9.3.2 Goals

- UNI counts with Software and equipment to produce high quality educational material for Computer based and multimedia learning.
- A small training facility is equipped with non-standard Human Interface Devices like force-feedback joysticks, gloves, touchscreens, as well as scanners, printers, CD/DVD-Burners, etc.
- Teachers involved with online course creation have basic knowledge in preparing multimedia and computer-based educational material.
- At least one career of UNI counts with extensive online educational material making heavy use of multimedia and cb-learning elements.

9.3.3 Project components

- Courses within the human resource sub-project.
- External courses and participation in Workshops on computer based learning.
- Multimedia training and research facility - multimedia-lab.
- Creation of educational material for (at least) one career.
- Promotion of the multimedia-lab at all faculties.

9.3.4 Project organisation

The faculty of electricity and computing and the educational science department form a task-force working group which takes over project leadership.

A research and promotion team is founded centered around use of the multimedia lab for research, teaching and creating of educational material.

9 Alternate Education

External assistance in course design and multimedia programming is contracted during two years, to boost the preparation of educational material for the selected careers.

Tight integration and feedback with standard network and computer facilities is assured by a close cooperation with CORC/UNIRED.

9.3.5 Technological requirements

- High performance Graphic/Multimedia Workstation
- a selection of non-standard Human Interface Devices
- Software for creation of multimedia and computer based learning material

9.3.6 Project Costs

multimedia-lab: US\$ 150000

Software: US\$ 70000

Specialized courses and external Workshops and Meetings: US\$ 20000

External consultants: US\$ 70000

10 Academic Publication

10.1 Online Libraries

10.1.1 Introduction

Academic publishing goes two ways: There is the need to easily access papers and information for doing research, but on the other hand, local research has to be published also, for remote and for local use.

The Online library project makes papers available on the net, especially from UNI researchers but it also tries to catalogize, publish and link documents from other nicaraguan institutions and authors, as far as seems appropriate to give students, researchers and the public in general access to the national outcomings and research.

The virtual library created hereby shall meet international standards and also provide international researchers access to data and special knowledge referring to Nicaragua's environment.

Researchers at the UNI and on a national level will be habilitated by providing proper write access to the bibliografic database and by training them to create compatible electronic documents.

A corresponding promotion is undertaken on the Internet, to make UNI's Online Libraries known to search machines and interested institutions.

To protect and underline ownership of the published papers, virtual libraries can be created by Faculty or by department. The software allows distributed submission, search and administration of documents.

Reader access to the online library is (at least) bi-lingual spanish/english, selected papers will be translated into the english language or spanish, whatever is appropriate.

10.1.2 Goals

- All electronically available papers from UNI authors are made available online
- All new papers from UNI authors are created/stored in standard electronic formats, which allow easy cataloguing, lookup, keyword search, etc. and can be integrated directly into the online library.

10 Academic Publication

- Selected papers which are available only in printed form are transcribed or scanned and put online.
- Proper organization, admission and publication politics for the online libraries operation are defined.
- Increased awareness about national research projects and use of its result among students and researchers is reached.

10.1.3 Project components

- Library server with sufficient Dataspace.
- Web-Site Software for publishing, keyword search, Author lookup, proper copying/downloading (respecting copyrights).
- Two specialized Terminals/Workstations with Scanners, OCR-Software, different Word-processors, document converters, etc. for creation, acquisition and adaptation of submitted papers.
- Initial collection fase: Aided by externally contracted persons, a mayor part of already available documents are put into the online library - two years.
- Promotion fase: Institutions and search machines are contact at international level, to make the UNI-online library available

10.1.4 Project organisation

The initial project fase will be governed by a commitee, composed of members of all faculties and a representative of the library staff. In this fase politics are defined and material to publish is selected.

External personal will be contracted to a) create the Computing/Web-Site/Database infrastructure necesarry, and b) to scan, convert and publish the material identified in the first fase.

The library staff takes over the coordination and responsability of the whole online library after this fase, while the faculty secretaries asume local library administration.

10.1.5 Technological requirements

- Server for publishing
- Distributed online library Server Software.
- Two Terminals/Workstation with scanners, OCR Software, Different Wordprocessors, Conversion Software, etc.

- Training courses for library staff and faculty secretaries in the use and administration of the online library.
- Preparation of a continuous course for library contributors about academic publication and writing standards, as well as about available tools to easy creation of high-quality academic papers ready for online publishing.

10.1.6 Project Costs

External contracts: Software US\$ 7000

External contracts: Paper collection: US\$ 15000 (two persons)

Server: US\$ 2500

Terminals, Scanner, Printers: US\$ 3500

10.2 Online Review Publishing

10.2.1 Introduction

UNI issues some scientific periodic reviews, which are also part of the scientific publication process as well as promotion of the institution. The Online Review Publishing sub-project will install facilities which allow electronic edition and online publication of these reviews.

In effect, the online reviews form part of the online library with respect to publishing in Internet, and experiment the same kind of promotion.

10.2.2 Goals

- Within one year all periodic publications of the UNI are immediately available in electronic form at the date of publication.
- Integration of the publication in the online library is accomplished and search by issue number, author, date, thema and keyword can be done.

10.2.3 Project components

- Upgrade/Substitution of Workstations used to edit the publications, to use Hardware/Software capable of electronic publishing and to integrate in the library/online publishing toolchain.
- Training of authors and editors of the reviews in the use of the tools.
- Coordination with the print shop to adapt to the new publishing technique
- Integration fase with the library/online library department

10.2.4 Project organisation

Public relations of the UNI is getting involved together with the library staff into the online publishing training and infrastructure upgrade.

Publishing of the reviews in Internet is handled as a sub-division of the online library.

10.2.5 Technological requirements

- Two workstations with online publishing toolchains as in the online library project.
- Training of responsables, authors and editors.
- Eventually compatibility soft/hardware for the printshop

10.2.6 Project Costs

Workstations, Scanners, Printers: US\$ 3500

Training costs: US\$ 2500

10.3 Tesis Database

10.3.1 Introduction

Students which do not assess the graduation courses habilitate themselves by the elaboration of a thesis, which is a requirement for the title "Ingeniero". Until now, the produced papers are just put into archive with one copy, which makes re-use and accumulative work difficult. As a related project to the online library, the thesis' will be available online via the thesis database.

This sub-project is virtually identical to the online library, with the difference, that a) academic registry comes into game via the qualification of the thesis b) Students care comes into game, by providing access means to the needed tools.

10.3.2 Goals

- Students are familiar with electronic publishing and use standard tools for their thesis, whose primary format is electronic.
- All new students thesis are available online as a sub-division of the online library.
- The elaboration of the thesis document and accompanying notes can be realized gradually, using computer and network resources of the UNI (thesis-accounts).

- Old thesis which are available in electronic form, as well as selected thesis in printed form are made available online.
- On each campus sufficient computer facilities are available with Software and Hardware needed to create and publish the students thesis.

10.3.3 Project components

- Upgrade/Equipment of faculties with graduation student accessible computer facilities for creation and submission of their thesis papers.
- Creation of a course for graduate students for electronic publishing, academic writing and utilization of the toolchains.
- Creation of access politics and an organisational scheme for thesis publishing facilities.
- Integration of the academic registry (notes) and the thesis submission/revision.
- Collection and online publication of selected thesis.

10.3.4 Project organisation

Each faculty organizes their staff for resource scheduling of the installed facilities, as well as for scheduling of the thesis students to the corresponding courses.

The application software department of OTIC assumes responsibility for integration with the academic registry sub-project. External programmers are contracted for the creation of the necessary Software.

The online library department assumes the interface and general administration of the corresponding online library sub-division.

10.3.5 Technological requirements

- One to three Workstations/Printer/Scanners for elaboration of thesis for each faculty, according to student capacity.
- Software to accomplish integration of the online library and the academic registry. A two step publication scheme in the online-library system has to take place:
 1. continuous editing/publishing during the creation phase, with supervising/revision facility on behalf of tutors, other students etc. until termination and qualification of the thesis. The thesis is only accessible on intranet.
 2. final publication on Internet within the thesis sub-division of the online library.

10 Academic Publication

10.3.6 Project Costs

12 Workstations/Scanners/Printers: US\$ 15000

External Contracts: US\$ 12000

Training Course development: US\$ 2500