Report of the Computing Support Committee

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March 26, 1998

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1 General discussion

1.1 Composition and tasks of the CSC

The Computing Support Committee (CSC) was established by the Director on December 9, 1997 and was composed of: Janusz Cofała, Andrei Gritsevskii, Gerhard Heilig, Marek Makowski - chairman, Daniel Wendt. The Head of the Computer Services (CS) Department was not a member of the CSC but did participate in all of the meetings the CSC had with users.

The CSC was established for the time needed to prepare a report that would:

- review the current state of computing support, and
- propose recommendations for improvement to the computing environment within the next 2 years - mainly for scientific activities but also for the administration and support departments.

The Director provided the CSC with a sample of questions and problems that CSC should consider. The sample served mainly as an illustration of the types of problems that the CSC should consider, but was not aimed at limiting the scope of the CSC. This report addresses all the questions and problems originally formulated and others identified by the CSC.

1.2 Organization of the CSC work

The CSC activities were composed of:

- 11 internal meetings,
- 5 meetings with: CADS, heads of administration and support departments, project leaders, Web Support Group and CS Department
- preparation and analysis of the questionnaire,
- and writing this report.

Additionally, members of the CSC met informally with several colleagues, who wanted to share their opinion and/or suggestions. Several comments were also e-mailed to the CSC.

1.3 Organization of this report

While it was our job to identify problems and to recommend ways of solving them, we should state right from the beginning that in several cases we have received contradictory opinions and suggestions. Moreover, in a few cases there was also no agreement between all members of the CSC. We have documented **all** received opinions and suggestions and we have tried to provide more detailed arguments for recommendations that are controversial.

The report is organized in a very simple way: Section 2 summarizes the current state of IIASA's computing environemnt while Section 3 provides our recommendations for improvements. These two sections contain the results of extensive discussions and are approved by the CSC. Section 4 contains comments, evaluations and recommendations by individual members of the CSC who wished to emphasize certain issues or wanted to express points of disagreement. However, we want to emphasize that the great majority of recommendations in this report is shared by all members of the CSC. Longer arguments and documentation of the CSC work is assembled in Appendices.

During its deliberations the CSC decided that certain issues should be analyzed in greater detail. Several members were asked to conduct special analyses of IIASA's computing environment or prepare summaries of the CSC survey results. These reports used in the CSC discussions. However, they do not necessarily reflect the opinions of all or a majority of the CSC members and are included as appendices.

The CSC questionnaire was processed automatically and various reports generated during this processing are attached to the this report. The lists of PCs provided by the CS Dept. are also included as attachments.

2 Current state of IIASA's computing environment

Much of IIASA's research agenda along with nearly all support activities seriously depends on the computing infrastructure. The continued scarcity of funds for computing during last few years coupled with the rapid advance of technology has resulted in a situation were insufficient resources are assigned for computing and productivity suffers. The current financial situation of IIASA does not allow for a quick recovery of our computing environment. However, financial investment is not the only measure necessary for improvement. Implementing various organizational changes would require a relatively small amount of resources but would also improve our computing environment.

In order to justify the recommendations presented in Section 3 we provide in this Section a brief summary of the current state of IIASA's computing environment.

The replies to the CSC questionnaire, meetings with users and information provided by CS have been used for the analysis of the current state of IIASA's computing environment. Only part of the results from the questionnaires are summarized in the following subsections. Reports that cover all answers to the questionnaire are posted on the Web and are included as appendices to the report.

2.1 General remarks on computing at IIASA

There is no common approach to computing at IIASA that applies to all research projects. A few of the rather large and with longer duration projects, e.g. ECS and TAP, have developed over years *in-house* computing expertise. They have staff members who are experts in specific areas of computing, needed for the project. However, a number of projects either can't afford or don't see a need to develop such expertise. Therefore, the level of demand for computing support from CS is determined not only by the amount and complexity of computing tasks needed in a project or department, but also by the availability of a project's internal expertise. Similarly (but to a smaller extend) several colleagues in support departments are advanced in specific areas of computing. Computing expertise within a project/department (as opposed to relying on the computing support provided by CS) was (and continues to be) justified by the need for having reliable and flexible computing support specific for that project.

The CS is doing a good job by providing services for the computing infrastructure and support that is dominated by trouble-shooting type tasks. Given limited human resources, the current approach that gives priority to this type of support results in assigning a relatively small share of resources for other support tasks. For example, programming support, consulting and participation in the development of applications, intelligence on new software tool developments and the promotion of new tools at IIASA all suffer. Such a situation has several negative effects:

1. A number of projects, and most departments, do have not enough resources for development of their own expertise and most of them do not have adequate computing support.
2. Staff members (both research and support staff) are forced to try various ad-hoc solutions, which are rarely rational in the long run (but adequate to solve a problem *now*).
3. The Institute does not have *a driving force* towards using up-to-date tools for programming and modeling, such as modern programming languages and tools (e.g. C++ with STL, Fortran90, software quality tools), modern modeling languages and environments for model building and analysis (e.g. structured modeling, AMPL, AIMMS).
4. Expertise developed in several projects is not available for other projects and departments (except for informal collaboration and contacts between advanced users).

Programming/application development support (especially for the administrative departments) could greatly improve productivity. The experience with the FIBU-DB implemented in 80-ties shows that it can be done and might be a cost-effective approach (in comparison to attempts at using commercial products which failed for both the FIBU and PE Dept.). Development of some software and database standards and approaches common throughout the administrative departments would greatly improve productivity and terminate the duplication of information. While a similar approach for research projects might not be applicable (not only because of diversified needs but also due to the shorter duration of a project's existence), it would obviously be a rational action to develop a more interconnected information system for the administrative departments.

2.2 Overview of the CS Dept.

While we concentrate our report on issues that require improvements, we want to stress here that the general evaluation of the work of our colleagues from the CS Dept. are positive. Only 7 (out of 133) evaluations of the CS support were negative. Similarly, the number of positive comments expressed during our meetings and several of the replies to the open questions were much higher than negative comments and evaluations. Several colleagues who evaluated the support as *fair* explicitly stressed that they did not evaluate the support as *very good* because some elements of the support are excellent while some other elements are either lacking or not satisfactory. We want to stress that a vast majority of IIASA staff generally appreciate very much the work of our colleagues from the CS, and their competence, friendliness and dedication.

We have not been able to perform our own analysis of the allocation of CS human resources to various types of activities. The best available for approximation of such an analysis is presented in Table 1, which contains data provided by the Head of CS (who however stressed that the data was just rough estimates and are not based on any documentation).

Type of activities	%
System admin activities (9% NT, 9% UNIX, 2% other)	20%
Solving user problems; Consultations (15% NT, 5% UNIX)	20%
HW problems, installation, upgrades (10% PCs; 4% UNIX, 6% other)	18%
SW appl. installations (10% NT, 5% UNIX)	15%
Development (Addr. db, Web appl.)	10%
General admin support (Nora, etc.)	10%
Training (NT appl.)	4%
Documentation	3%

Table 1: Estimation of allocations of the CS human resources in 1997.

Considering the fact that the human resources of the CS Dept. in 1997 were composed of about 10 person-years, 10% of time corresponds roughly to one position (man-year). The estimation presented in Table 1 and the fact that the CS human resources were decreased for 1998 by about 30%, calls for rethinking of the scope and priorities of the services provided by the CS. Currently, they are driven by the user's demand. However, very little has been done to reduce the demand for the most time consuming services of CS. The improvement of training, information, and undertaking other organizational measures, (including acquisition of appropriate hardware and software) could reduce user demands on CS and free them other computing needs. Such reducing of the demand will take time and financial investment, but it seems to be the only way to keep the current level of user's satisfaction while decreasing the human resources in the CS and facing new generations of software which typically require more support.

There is currently no adequate information about CS - their policies and their constraints, i.e. what they can and should provide, what are the priorities for dealing with constraints. Many users consider CS as been "all things to all peoples" while others don't even try to request some services. If we continue in this way (especially with the reduced human resources of the CS and increasing demand for services), then more staff members will be dissatisfied with the quality, responsiveness and depth of support. The CS staff will also be frustrated because they will not be able to meet the demand for support.

2.3 Demand for computing

The count of all users having used any of our systems between February 10th and 20th is 159. Therefore, the 135 replies to the survey provide a good picture of our computing environment. The results from the questionnaire are a little bit more representative for the research staff (67 replies) than for the CS Dept. (5 replies) and for CADS members (26 and 35 replies from secretaries and from other support staff, respectively).

Table 2 summarizes the intensity of various types of office of applications by all users while Table 3 provides the same type of information for both scientific and office-type of software used by researchers[1].

Type of computing	intensive	often	rarely	not at all
Text and graphic	78	35	13	7
Web	41	75	16	1
E-mail	63	59	11	0
Other office appl.	26	56	37	14

Table 2: Intensity of use of office type of applications by all users.

Type of computing	intensive	often	rarely	not at all
Modeling and progr.	20	19	15	13
Data processing	18	25	8	16
GIS	2	6	16	43
Other scient. appl.	6	19	18	24
Text and graphic	42	18	6	1
Web	21	42	4	0
E-mail	32	33	2	0
Other office appl.	9	30	22	6

Table 3: Intensity of use of software by researchers.

Results summarized in Tables 2 and 3 show that office-type applications – especially text processing and graphics – clearly dominate computing at IIASA. Modeling, programming and data processing are intensively or often used by more than half of researchers that responded to the questionnaire. These computing activities are not supported by the CS. Analysis of the software use shows that up-to-date software for modeling and programming is rarely used.

The following subsections present a more detailed discussion about text processing, the Web, WorkFlow and data bases.

2.3.1 Text processing and graphics

Text processing is by far the most intensive type of computing at IIASA, therefore it is discussed in more details here.

We have good in-house support for text processing (the number of users who evaluated it as bad or *not available but needed* was 9 and 1, for MS-Word and LaTeX respectively). However, many experienced users of MS-Word face serious problems with processing complex documents (even on the most powerful PC's at IIASA).

MS-Word is used by a majority (86.6% of all researchers and 73.8% of all support staff who have answered the CSC questionnaire) of users and it is a part of the standardized setup of NT.

[1]There are only 4 CADS members who use data processing intensively or often, no other scientific software listed in the upper half of Table 3 is used at least often by non-scientific staff, therefore data for research staff was reported in this table.

The results from the questionnaire show that LaTeX is used by at least 48 persons (incl. 18 intensive and 15 often users). Many users (including the Publication Dep., CS Staff who support text processing and many experienced users of MS-Word) consider LaTeX as a more appropriate choice for complex and/or large documents that produces a higher quality output with less effort. Many publishers (both of books and journals) and organizers of conferences request contributions in LaTeX. Therefore, the Publications Dept. does a majority of its work using LaTeX. Finally, LaTeX is a widely used and stable product, its basic components are public domain and require much less resources than MS-Word. LaTeX is also cheaper to use than MS-Word (which has a new version every second year that requires both up-to-date hardware and licence fees for upgrades). Last but not least, LaTeX requires less support than MS-Word and the support and maintenance of LaTeX is easier. Therefore, both the number of users and the features of LaTeX fully justify continuation of its use and support at IIASA.

In all the discussions we had with the project and departments, the need for advanced graphics support was clearly expressed. The services provided by the Publication Dept. (for which projects are charged directly) are needed. Various graphics packages are used by many users who don't need to ask for the help of the PUB Dept. However, in many situations when professionally (for uniformity for multi-author publications) made graphics are needed, this service should be provided by staff of the PUB Dept.

2.3.2 The Web

The CS has been promoting the Web for several years. However, only after improving the external connection about a year ago has the use of the Web at IIASA been growing. Results presented in Table 2 show that the today Web is intensively used. On the other hand, common knowledge shows that information placed on the Web is often not read. This is mainly caused an inadequate organization of the information on our Web, which makes it difficult and time-consuming, even for experienced users, to find needed information and/or be to alerted that such information exists. The design of our Web page is also no longer adequate for the amount and complexity of the information available on our Web server.

Most importantly, our use of *"News"* for internal information makes is practically impossible to rationally manage and access this information. Some important limitations are:

- Articles from the News are removed after 4 days. Therefore, announcements are either made too late or have to be reposted.
- Information that should be available for a longer time is mixed with news of a temporary relevance (e.g. "a certain server will be down tomorrow").
- Searching for information is available only for a small group of advanced users (but even for them it is cumbersome and not efficient).
- Posting information in a reasonably nice form requires knowledge of HTML or of a tool that generates an HTML document.

Currently the information available on our Web is stored in thousands of files. Given the fact that the amount of information is growing fast, continuation of the current approach will soon result in an unmanageable mess. The solution seems to be obvious: the information should be stored in a DBMS and made available on the Web in an automated way. Even if more users were eager and able to master tools for posting info on the Web, this would not be a rational approach for a majority of active users of our Web. More advanced users may want to learn (or continue to use) tools for making Web pages, therefore, both (using predefined forms and creating customized Web pages) approaches should co-exists. However, customized Web pages need to be managed by the Web administrator. The limited resources for the Web administration on one hand and fast growing amount of information on the other, call for the automation of handling the most frequent types of postings (such as those currently handled by the *iiasa* News groups). Such information might be submitted by standardized forms that can easily be used by everyone and handled by a DBMS.

In 1997, one project organized two workshops almost entirely via the Web and it is repeating this in 1998. Another project uses the Web for helping in the organization of a workshop. The results of these approaches are very encouraging. However, the researcher who has implemented the prototype of the Web based workshop organization has no time for converting the developed tools into tools that can be used by anyone.

2.3.3 WorkFlow

Over a year ago, work was initiated on analyzing of the possibilities and needs for putting major IIASA documents into electronic format. A special WorkFLow Committee was created. The Committee analyzed the possibilities of computerizing frequently used forms. However, the results of the committee's work seem to be modest. About 50 forms were identified, but none of them were put into electronic format. Since late December'97, Serge Medows has responsibility for the implementation of WorkFLow. Serge understands WorkFLow in a much broader context. In his opinion, it should include: tools for documents management (searching for documents, viewing them, exchanging information about documents among IIASA staff members, cross-referencing), group scheduling, group data analysis, report-driven conferencing etc. Currently work concentrates on identification of tools available as shareware. However, the document management tools available as a part of Oracle has not been considered yet. Commercial packages cost several hundred thousands US$ and need tailoring to the needs of individual users. Thus, according to Serge, tools should be developed at IIASA. Procedures are being developed for storing documents in electronic format in Archives. According to Serge's estimate, computerization of most important forms would require about 1.5 - 2 man-years.

The concept of the implementation of WorkFLow at the Institute is defined very broadly and is rather vague. Development of very sophisticated systems does not seem to be appropriate for a small institute like IIASA. The most important question, which remains to be answered, is: *Which elements of paper work should be moved to computers in order to improve our productivity?* The CSC agrees with opinions of many colleagues that a number of procedures should be computerized, for example forms with clearly defined and unambiguous flow (e.g., travel authorization, leave slips etc.). However, we also agree with reservations expressed by some of our colleagues that there are procedures/forms (e.g. in FIBU or PE) that might be difficult to computerize and therefore it might be rational to keep them on paper.

A prerequisite for the successful implementation of the elements of WorkFlow is a careful analysis of its requirements and a robust implementation. Negative experiences (see below) with the Address dB justify well this prerequisite.

2.3.4 Data bases

Data processing is one of the intensive computing activities (cf Table 3 on page 4)identified by the survey. Access, FoxPro and Oracle are used intensively or often by 24, 3 and 7 users, respectively. Support for Access and Oracle was evaluated as good by only 4 and 1 user, respectively.

The Library catalog on the Web is used by 71 users. 37 colleagues (including 10 researchers) do not know that it exists. Improvement of the library catalog on the Web is essential or desired for 20 and 19 users, respectively. The old libcat is used only by 17 users (however 87 users do not know about it).

The Address dB (ADB) is used by 10 persons (72 don't know about it, and 27 declared that they don't need it). Almost all colleagues stressed that they prefer to use an ADB that is maintained by a project or a department. Potential users of a central ADB are afraid that addresses in such a dB will not be kept current and that it would not be rational to use a huge dB (the ADB currently maintained by the PUB Dept. contains over 15,000 addresses). A typical project, however, needs just few hundred addresses. Moreover, the interface to the ADB does not meet the needs of most the users of MS-Words and no interface is available for users of LaTeX.

A substantial amount of resources have been spent on the implementation of the central ADB. In our opinion no adequate requirement analysis for such a dB has been made and the effort for the implementation of the ADB has been to a large extend wasted - mainly because the implementation assumptions and the design of ADB do not meet the requirements of users.

2.4 Recognized problems

The following subsection summarizes the various types of computing problems that have been recognized. However, many detailed problems which do not require explanations are included in Section 3. The problems are grouped into sets of problems by type. Therefore the sequence of presenting the problems does **not** reflect their importance.

2.4.1 Organization issues

Organization and information seems to be the two areas in which a lot of cost effective improvements can be made.

Several colleagues are skeptical about the chances for improvements in our computing environment. This skepticism is based on the results of many past discussions, which have not been followed by actual actions. Indeed, a status of many recommendations of the *Visiting Committee on Computer Operations and Services* and of other discussions is not clear. The situation with the central address data base and also with several requests made on the CS Web help page (the oldest pending request with still unknown completion date was submitted on July 3, 1997) demonstrate weak elements in our organization.

Many colleagues pointed out in replies to the open question various problems caused by inadequate information. This is illustrated also by the following two components of the questionnaire results:

- overal evaluation of the day-to-day communication with the CS: 46 - very good, 41 - fair, needs improvement - 19, no opinion - 27.
- 53 and 84 (out of 133) colleagues do not know about telephone hot-line and the Web-based CS help, respectively.

Several comments indicate a belief that scientists (and especially project leaders) have better PC than secretaries. This is often not true (please see Appendix A.1 for details).

2.4.2 Computing support and training

About 50% of responses to the question in the survey regarding the most important improvement of computing environment at IIASA, and more than 30% of free comments, suggested necessity of upgrading of the current level of support and training. There was only one suggestion that in-house training is not necessary and should be discontinued. Questions from the questionnaire addressing directly the problems of Support and training clearly indicate that the improvement in this area is needed(see Table 4).

Rank	Support			Training		Availability of documentation
	Software setup	Program.	MS-Office package	Availab.	Quality	
Very good	47	25	41	7	19	18
Fair	45	51	51	45	42	59
Not satisf.	6	24	8	48	39	24

Table 4: Assessment of computer support and training activities at IIASA in the survey (% of all responses other than 'no opinion')

Comments about the quality of training are very diversified, many are positive and few are negative. The evaluation of the support quality is generally very good or at least fair. The main reservation regarding the support is its availability. Several colleagues worry that the support availability will be no longer satisfactory after Martina left the CS.

2.4.3 Software

The move from Win 3.x and Win'95 to NT (together with the associated improvement of PC hardware and the network) made in 1997 resulted in a much better working environment for most users of PC. However, it has created addtional substantial service load and resulted in serious problems for colleagues who still use PC's which could have been used for Win'95 but are not adequate for NT. (cf Section 2.4.5 for details). These both transition problems should dissappear, if enough PC's will be replaced before Summer'98 and when experience of users (preferably supported by adequate training and information) will grow.

The CSC shares the following comment made for the questionnaire:

> Each new generation of software demands better and faster hardware, which in turn, grows obsolete alarmingly quick. Therefore we seem to be perpetually working in a slightly unstable 'catch up' mode where we try constantly to familiarize ourselves with new systems. A deliberate Institute policy to settle for stability (i.e. not change software and hardware with each generation), may be desirable and advantageous both in terms of support manpower and of computing environment stability, in addition to helping the budget situation. I believe most users would prefer stable computer services that are 1-2 years behind 'leading edge' technology to an unstable environment.

Since about 1980 IIASA is no longer close to "leading edge" of computing hardware, but we try to be much closer to such an edge for software. In fact we are now too close, were adequacy of PC and Sun hardware for the newest versions of some software used at IIASA are concerned.

2.4.4 Unix and NT

The CSC has examined more closely the use of Unix and a need for continuing its support.

Unix is not only used on all of our servers but it is used and needed by 54% (71 out of 131) of users who replied to the questionnaire.

Tables 5 and 6 justify this statement by the relevant results from the questionnaire.

% of activities	0%	[1,19]%	[20,49]%	[50,79]%	[80,100]%
number of users	62	22	18	15	16

Table 5: Number of users with various percentages of the total computation activities that is done under Unix OS.

	impossible	difficult	easy	no opinion
number of users	30	24	10	69
% of users of Unix	46	38	16	–

Table 6: Evaluation of problems with moving applications from Unix to NT.

Table 6 contains evaluation of 71 *direct* Unix users (many other users don't even know that they are using Unix-based services) about difficulties of moving their work and applications from Unix to NT (the numbers in % row are calculated as a percentage of 64 users who evaluated such difficulties). Should a decision of moving all computing at IIASA from Unix to NT be made, then over 80% of *direct* users of Unix would have serious difficulties. Therefore all members of the CSC agree that a continuation of Unix support for Unix-based applications is necessary.

The CSC and the staff of the CS Dept. are convinced that, at the present time, Unix has clear advantages over NT as an OS for servers. Selection of an OS for our servers is of critical importance for reliability, security and efficiency of basic services. Therefore, the arguments for a continuation of Unix are summarized below.

The arguments for using Unix as OS for all (except of NT specific) services are based on an evaluation that Unix is a much more stable, robust and efficient OS and that these are the most critical factors for a selection of an OS for servers and for the OS of a computer used by several users. Here are the main arguments that supports this statement:

1. Simplicity (especially, if compared to NT). Unix runs just services that you need and allocates almost all resources to these services.
2. Robustness and "boolet prof" design which results from its simplicity. Code is available and tested over the years. The robustness of Unix is well illustrated by the problems with hanging-up/crashing of machines running NT which are much more frequent than the same machine running Unix.
3. High level of security and integrity protection results from lessons derived over 20 years of constant attacks from various hacker groups. There are a very limited number of security holes in Unix as a result of this "evolutionary" process. MS-Windows NT has a higher vulnerability to viruses partially due to the tighter integration of WWW services. Therefore, nowadays hackers mainly brake in to the NT machines.
4. Slim (compared to "fat" NT) design. No friendly user interface and no advanced multi-process multi-task communications makes it much smaller in size and easier to control. Unix has efficient and robust interprocess communication. Protocols and tools (like PVM & RPC) allow for easy and efficient distribution of tasks between computers. On the other hand, every advanced user of NT is familiar with problems related to use of DLL's and many undocumented features of NT. In particular, installation of an application may modify the critical parts of NT (common dialogs and shell DLLs).
5. A large number of tools for administrators. Users are interested in services and not in how maintenance of servers is being done. However, maintenance is critical part of administrating. NT suffers a lot from a lack of such tools. This is one of the reasons why MS introduced Pearl scripting language as a part of their Resource Kit for NT. In most cases Unix tools come with source code, that can be adjusted for specific configurations.

The above arguments are supported by many Intel-based computers with a Unix OS that are used as servers and workstations.

2.4.5 Hardware

In 1997, two big hardware improvements were made. First, the qualitative increase of our Internet connection which moved us from an ancient band-width to a reasonable connectivity level. Second, the upgrade of the LAN which also qualitatively improved the connections of each machine (the last part of this upgrade is still being implemented).

However, we still face three serious hardware problems:

1. The situation with the PC's has always been a problem but a move to NT and the smaller number of PC's purchased in 1997 has caused serious problems for many users (e.g. a secretary can't edit a report because her PC's can't handle it, therefore the report has to be edited by a project leader). A detailed analysis of the situation is provided in Appendix A.1.
2. All of our servers (with the exception of rhine purchased in 1995) and all Sun workstations are more than four years old (half of the systems are more than 5 years old and can be considered obsolete and are not adequate at all for currently used versions of the Solaris OS and Unix based applications). Our workstations are equipped in most cases with 40-60 MHz processors (currently available Sparc computers have processors in the range of 200-600 MHz). After the installation of structured network cabling in the Schloss is finished, we will have good, reliable and fast network. The bottleneck will be the servers.

3. The only one relatively new (three years old) Sun server (rhine: two processors [160 MHz] Ultra Sparc) is used not only as a file server but also for most of numerically intensive computations. At least four projects (ADN, ECS, TAP and RMP) are running such applications and not only frequently facing problems if more than two such applications are executed at the same time but also causing problems for other services run on the rhine, especially file services and make it a very vulnerable point.

There are several other problems that should also be solved, if resources will be available:

- A pool of computers (both PC's and Unix WS) for visitors and short-term staff members are no longer available.
- An adequate number of computers for YSSP is a persistent problem.
- Notebooks for travels have been purchased by a few projects that use them intensively. However, smaller (or with a tighter budget) projects also need notebooks for making demonstrations or presentations outside IIASA.
- Computers with several processors or with parallel or vector architecture would be helpful for several time-consuming applications. However, what really is needed that at least one computer (with two processors) which is *not too far away* from top-class performance needs to be replaced every second year).

3 Recommendations

The recommendations are organized into the following three sections that corresponds to Organization, Software and Hardware issues. All of these elements (i.e. organization, software and hardware) are mutually dependent and are important for achieving a better computing environment. Only a small subset of the recommendations suggests actions that should be directly taken by the Director. Several other recommendations contain, rather, the formulation of a problem that should be dealt with more than a concrete proposed solution. However, the majority of recommendations consist of well defined proposed actions.

The implementation of some of the recommendations will require considerable resources (either financial, human or both) while other solutions may be introduced at little cost. It is beyond the scope of the CSC to evaluate the resources needed for implementing each of the actions, therefore we do not propose any schedule for their implementation.

Many of the recommendations formulated below have been already suggested - some of them several times. However, we repeat all recommendations that we consider to be still valid because it is not at all clear the degree of implementation of previous recommendations.

3.1 Organization

3.1.1 General

1. Improve communication between users, CS, IIASA management and its advisors in order to:
   - provide users with enough information needed to clearly understand existing possibilities and constraints,
   - provide CS with up-to-date information about the demand for various types of support,
   - take advantage of information and expertise of people not directly involved in a decision making process nor in support.

   This can not be achieved by a one specific action but rather by a carefully composed set of long-term actions. Some of such actions are recommended below. A questionnaire (similar to that made by the CSC) may continue to be a valuable source of information.
2. We do not recommend to form any external visiting committee for a yearly evaluation of our computing situation. It would take a few years until such a committee would be able to recognize the situation well enough to provide us with sound advice. A standing committee (like CPOC) is not contributing much to evaluating the computing situation

and suggesting solutions. Therefore, instead of standing committees we recommend to call ad-hoc committees for specific tasks (like a yearly evaluation of the Plan (cf rec. 3)) or problems. An external evaluation on a commercial basis may be arranged for specific problems for which we do not have adequate in-house expertise.

3. Update every year the *Plan for the Development* of our computing environment (made in April'97) that should continue to have a 2-3 year horizon. The Plan should be extended by a more careful analysis of computing needs of both research projects and administration, and assess to what extend these needs are met. The Plan should be prepared by the Head of CS in consultation with project leaders and heads of departments. Then it should be evaluated by an ad-hoc committee.
4. Identify needs for support, software and hardware systematically and possibly well in advance. This should be done by the Head of the CS and be trade-off between development of applications, tailoring existing applications/tools or using ready-made products for each application requested from the CS.
5. Improve information about computing related problems (both its contents and organization). Options, decisions and plans should be posted on the Web and systematically reviewed and updated. Information about plans should include an up-to-date schedule of their execution. The recommendations from this report should be reviewed and those approved should be posted on the Web with a schedule of their implementation.
6. Organize regular seminars. These should be organized by the CS, however, not necessarily always presented by the CS staff. External speakers and non-CS IIASA staff should also be invited for making presentations in order to:
   - advance the computer literacy and capabilities of our staff, especially about topics such as the Web, network, e-mail, dB, graphics design with a computer, software for mathematical applications, etc.
   - "look ahead": intelligence and dissemination of information about new trends, techniques, tools, opportunities (e.g. E-commerce).

   The seminars could be also take the form of a forum for discussing plans and problems. The interaction of the large number of colleagues with the CSC show that there is a lot of interest and willingness to cooperate in improving our computing environment.

3.1.2 The CS Dept.

7. Define precisely the scope and realistic priorities of services to be provided by CS and make it know to the staff. The human resources of the CS in 1998 are about 30% smaller than those in 1997. On the other hand there is a justified demand for new and/or improved services. We suggest the following approach to achieve this goal:
   - Demand for particular types of CS services should be carefully examined by the CS. One should consider which time consuming services can be partly replaced by training, improved information and organization, acquisition of appropriate hardware and/or software.
   - A consistency between the available resources (CS staff and budget) and scope and standards of services should be carefully examined by the Director and the Head of CS, with consultation of a representation of users. This might show a need to increase the resources for the CS.
   - The CS should be considered by users as a team. However, primary responsibilities of each of the CS member should be clearly defined and job descriptions and expertise should be known for all users. Stability of services is an important element, therefore the scope of services should not be changed often. An evaluation of CS as a whole should be performed regularly.
8. Improve the CS Request Web page (in particular the help button should be available on the IIASA Web home page) and encourage its use. Each request should have assigned, as

soon as practicable, both the ETA (expected time of "arrival") and the responsible person. Automatically generated e-mail should be sent whenever the status of a request changes. A properly organized and managed Web Request will not only gradually replace most of requests made by a hotline but it will help the user to understand that sometimes there have been several requests made prior to her/his request; it will also allow for a rational analysis of a demand for various types of CS services thus helping to finding ways for replacing a case-to-case services by a more general solutions, as recommended in rec. 7 and for an objective analysis of response time. Continuation of use of the telephone hot-line and creation of a help e-mail address is recommended. However, the Web request should be improved and promoted as the primary way of reporting problems and asking for support. Use of portable phones and/or beepers was also suggested, but a rationality of these solutions should be assessed by the CS.

9. A suggestion/comments box should be created and maintained on the Web.

3.1.3 Support and training

10. Make support and training a priority in CS activities. Great importance of this issue has been stressed by all groups of IIASA staff during the meetings. All groups of computer users share the view that the best way to increase the efficiency and productivity of work is through appropriate training. Training should also include training of trainers, i.e., the CS staff.
11. Provide in-house basic training for frequently used software. It is absolutely essential and should be further developed instead of being reduced - as what happened in 1997. Training should concentrate on the most frequently used applications, especially those for which there is large demand for every day support, e.g. MS-Office applications (Word, Excel), Eudora (efficient use), and graphic packages on which design could be made (Corel, Designer, PowerPoint). Training should also be provided for Web use (both passive and active) and for making presentations on a PC. The training will be especially effective for the CADS members (over 80% work at IIASA longer than 2 years).
12. Organize training courses at different levels of advancement (beginners, intermediate). They should not be limited to seminars but should include hands-on training. External trainers could organize such courses, especially at the more advanced level. Alternatively, CS staff should be offered an opportunity to participate in training courses for trainers so that persons responsible could later organize training in the Institute at a professional level.
13. Provide every new user (i.e. a person for whom a login name is created) with an introductory session made by a CS at his/her WS. The practice of group introductions for YSSP should also be continued.
14. Consider self-education as a supplement to in-house training courses. This can include purchasing educational videotapes of high level courses training courses based on CD-ROM, additional books that concentrate on efficient use of tools rather than standard user guides. It is important to offer the possibility to use the educational tools after working hours to those who have a reasonably new computer at home. Since computers required for such training need to have multimedia options, one or two computers at IIASA should be made available on a sharable basis. CS should take responsibility for coordinating such activities.
15. Continue and extend support dependant on troubleshooting and hints how to efficiently perform certain operations. This should include information "hunting" and organizing it in a form of "simple language" frequently asked questions (FAQ)[2]. Such a FAQ database should be organized and maintained by the CS. However all users should be welcome to make contributions. Queries by examples should be implemented in this dB. Staff members not employed in CS but having experience in using a certain type of software may also be involved in such a support. Experience and information that can be gained from various

[2] Cf also Section 3.2.5.

newsgroups concerning different computer topics (e.g., NT, Word, Excel, Access maintenance and troubleshooting) are quite valuable. It should be disseminated through short summaries that would include important tips and tricks. It is also advisable to create a WWW links list of frequently asked questions for various topics (software discussion group, software use under NT, network, Internet etc).

16. Continue and introduce more training for graphics (including use of packages like Mathematica or Matlab also for graphics). The key issue is the development of a set of standard robust procedures for everyday use of graphics (e.g., how to insert graphics in Word step-by-step, how to make PS and (or) EPS in such a way that it can be used with Word as well as with LaTeX, how to prepare output for Web publishing, how to make a PDF file out of the document, how to convert from format A to format B and what are the limitations). It is also important to provide hints on how to efficiently use IIASA standard graphical packages as well as on developing routines for more complicated conversions of graphs from one format to the other for specific use.
17. Improve information about software and make it available in a dB. Currently existing database on software is up-to-date but the way it is organized makes it hard to use. A division into two groups should be made: standard software officially supported by IIASA and software available but without onsite support (see also rec. 24). In order to disseminate information on what is available at IIASA it is advisable to organize a fair demonstrating what packages we currently have and what are the most important features of each package. Software on order and new acquisitions/updates should be also included in the dB.
18. Improve access to hardcopy documentation of software and training books. More funds should be made available to the library for purchasing of extra copies of user guides as well as the books that are supplementary to standard documentation. When selecting such books, quality should be of primary importance, price playing a secondary role.
19. Update "The Guide to Computing at IIASA" regularly and include links to the proposed dB with FAQ and tips. The Guide should be split into several documents, each having a date stamp of the last modification. Its part related to NT should be greatly improved.
20. Acquire and distribute expertise on the emerging Java platform.

3.1.4 Misceleneous

21. Provide each user (who will request it) with a `rwx-w--w-` directory on his/her I: drive (/t/user directory) and in the /incoming directory on the ftp anonymous server. These directories should be used for transferring files which require privacy. A daemon should check newly arrived files (say every hour) and send e-mails to a person who received a new file.
22. Provide one-line information about each user (containing: project acronym, tel. ext., room number and URL of the Web page) should be stored and updated in `~user/.project` files. An alias should be defined for a fast access to this information.
23. Plan and announce the switching down computers for service or upgrade well in advance.

3.2 Software

3.2.1 General issues

24. Create a list of software that is kept up-to-date by the CS and consult it with users. Software that is currently used should be either included into this list or a discontinuation of selected items should be agreed with users. The list should be composed of two parts: First, software that is maintained (purchased, installed and upgraded) by the CS. Second, software that is additionally supported (i.e. help of solving typical problems is provided) by the CS. The standard set-up of NT should be extended by: WinZip, a virus checker and QuickView Pro.
25. Update the dB of the available software (for both Unix and NT) regularly and include short

description of the software and links to more information whenever available. Man pages for Unix software should also be complete and up-to-date.

26. Provide a policy for upgrading of software that is consistent with the availability of hardware required by a new version (which typically requires more resources).

3.2.2 OS

27. Continue Unix and NT as the two primarily used OS. Unix should be kept as OS on all servers (except of NT-specific services) and on Sparc workstations. NT should be used on all Intel workstations. Other OS should be used only, if there are good justification for it (including no requests for CS support and external funding). More detailed discussion about Unix and NT is given in Section 2.4.4.
28. Use only one version (including patch level) of Solaris UNIX and of NT on all machines. The move to a newer version (level/patch) of OS should be well prepared and tested in advance. CS should not support non-standard versions of OS or non-standard versions of application software.
29. Provide at least one machine that runs an older version of each OS (including Win'95 and Win 3.x) as long as it might be needed for running (or testing) software under an older versions of an OS.

3.2.3 Text processing and graphics

30. Continue both maintanance and support for LaTeX (please see Section 2.3.1 for detailed arguments). Support for LaTeX should be on a similar level as support for MS-Word. Purchasing of user-friendly front ends for LaTeX would ease use of LaTeX for less experienced users and is therefore recommended.
31. Continue graphics support by the Publication Department.

3.2.4 Scientific software

32. Organize a series of seminars that would demonstrate the capabilities of software that should be considered for use at IIASA. Results of the questionnaire demonstrate that the usage of modern scientific packages for data analysis and modeling is rather low. The situation can only be improved if more information about various modern tools is provided. As a starting point a list of scientific software with a short description of areas of applicability should be prepared and disseminated among IIASA staff. Based on it, potential users should communicate to the CS what packages they would be interested in. For those packages seminars could be organized by qualified IIASA staff (not necessarily from the CS department) or by external consultants. Thus in case of need, external consultants could be involved and contacts established (e.g., from the Vienna University, user groups associations). IIASA might consider signing framework contracts with appropriate experts.
33. Consider software tools for modeling (like AMPL, AIMMS, MPL), expert systems shells, CASE tools and software quality tools (like Purify, BoundsChecker) to improve the efficiency and quality of modeling and software development.

3.2.5 The Web and WorkFlow

34. Reorganize our Web site's structure so that important information is not buried deep down on a low level of the hierarchy (the depth of the hierarchy should be reduced). Our Web presence has not kept up with the rapid development in the field and it requires a substantial improvement. Scientists should be encouraged and supported to add interactive scientific content, such as databases or interactive models. Organization of workshops via the Web should be implemented and supported.

35. Improve the internal use of Web. Easy to use forms should be created for putting information (e.g., announcements, documents) on the Web. The information supplied by such forms should be maintained by Oracle. Oracle is also recommended for the management of the thousands of documents that are currently "managed manually". Introductory courses, including hands-on training should be organized. More complicated operations, like creation of Web pages with graphics and complicated layouts, should be done with the assistance of the personnel of the Office of Information.
36. Create links to URL's containing hints and tips (cf rec. 15). For example, to a few of the hundreds of support and help pages for the MS-Office software packages at the Microsoft web site; there are hundreds of tips and tricks how to use various features in MS-software; maybe this will help users to find training and support information on the web.
37. Provide zipped (compressed) copies of each large document (that is accessible from outside of IIASA) on our Web server (especially all IIASA publications) along with an original version.
38. Implement SSL (Secure Sockets Leyer: security utilities and certificate) for the Web. Consider also implementation of the SET (Secure Electronic Transactions) protocol.
39. Concentrate efforts for WorkFlow on implementation of computerized versions of frequently used forms. Forms with clearly defined and unambiguous flow (e.g., travel authorization, leave slips etc.) should be given priorities. CSC is of an opinion that the implementation of five to ten forms could be done within about two months. Also the results of efforts towards implementation of WorkFlow in Archives should be reviewed. Based on that review, further decisions about continuation of work for Archives as well as about similar types of activities in other departments should be made. CS should provide support for the document management utilities included in Oracle.

3.2.6 Data Bases

40. Maintain expertise and provide support for both Access and Oracle with CS. Oracle should be remain our dB server (according to the Plan of April 97) and should be used for complex and/or multi-user applications, and also for applications that require a high level of reliability and security. Oracle applications should have a user-friendly interface, preferably via the Web (see also Section 3.2.5).
41. Update and implement the proposal by G. Heilig of April 7, 1992[3] (and followed up discussion) regarding scientific data bases.
42. Implement a consistent approach for all administrative dB's in order to avoid the duplication of data and to achieve a reasonable level of access to relevant data by authorized personnel.
43. Port the library and publications data bases to an up-to-date DBMS based tool. Preferably, specialized commercial software should be used for this purpose. The Library and Publication should select the software in collaboration with the CS. If no suitable/affordable software can be found, then these dB's should be ported to Oracle.
44. Create a bibliographical dB of the library dB and of the IIASA publications. Such a dB should provide selected entries in at least BibTEX and MS-Word formats.
45. Redo the requirement analysis for a central address dB. The server/client architecture (proposed in the Memo of October 8, 1996 by Asen) should be implemented. Support for LATEX and a quick command-line access to the information should be implemented. An easy-to-use front end for the Web and for MS-Word is also needed.

3.2.7 Other software

46. Install a commercial fire-wall system. Additionally, passwords on the gate machine should be different from those used on all other machines.

[3] Cf Attachement B.

47. Make operational the upgraded software for sending faxes via a computer. Scheduling for sending faxes at times with lower connection prices should be implemented.

3.3 Hardware

3.3.1 Servers

48. Systematically upgrade servers in order to provide reasonable levels of efficiency and reliability. The high maintenance costs of old machines should be taken into consideration. The following three type of services should have priority: file services, numerical computations and the Web. DBMS should be added to this group when its use increases. Each of these services should be provided in such a way that its efficiency and reliability will not be influenced by pick demands for any other service.
49. Purchase a new machine (Sun or a Sun compatible) before Summer'98 for numerical intensive computations (a purchase was planned for 1998 in the *Plan for the Developments of IIASA's Computing Environment in April, 1997*). A min. configuration should include two (at least 300 MHz) processors and 512MB RAM.
50. Improve the current arrangement for the common network file services. A single, relatively simple computer, such as our rhine Sun server, cannot be efficiently and robustly used for the two most computationally demanding purposes, namely the main network server and a number crunching server. There are at least two alternative solutions. A dedicated file server (e.g. NetApp) could not only greatly improve file services but also may decrease needed resources for system administration. However, it is expensive (starting configuration might cost up to 0.5 mln AS and reasonable equipped file server will cost much more). An alternative solution could be to use 1-2 Intel based PC's running network file services (NFS, or VFS, or even something else) under PC Unix using appropriate hardware storage ("wide" SCSI or a similarly fast design). Both solutions (and, probably, some others) should be compared in detail using a cost-benefits analysis. In any case, the network file systems must be reorganized in such a way that a slowdown or even the hanging of one machine should not cause problems for the rest of network (at least for its basic functionality). A solution for this problem should be based on a statistical analysis of the current network load of corresponding communication protocols.
51. Equip all servers with a UPS.

3.3.2 Network

52. Implement the plans specified in Sec. 2.3 of the *Plan for the Development of IIASA's Computing Environment*.
53. Insure that all switches are of good quality in order to avoid the problems that we faced in 1997.

3.3.3 Intel-Based Workstations

54. Purchase enough PC's each in order to provide all intensive users with a machine that is not older than 3 years. Type and configuration of a PC should correspond to the requirements of the used software. Each new PC should be equipped with a CD reader. About 25 users (mainly members of CADS) use inadequate PC's (cf Appendix A.1 for the analysis). This number should be verified by examination of individual needs and enough PC's should be purchased to make it possible to provide each staff member with an adequate PC before Summer'98.
55. Recognize the computing needs of the YSSP well in advance. We should continue to encourage the YSSP'ers to bring-in their own laptops. High-end machines should be allocated for YSSP using the same criteria that are used for staff (i.e. only, if computing needs justify it). However, meeting such needs should not be done at the expense of not providing staff

members with upgraded PC (in such situations, the leasing of PC's for YSSP'ers should be considered).

56. Examine the purchasing of additional RAM as a cost effective solution for upgrading usable life-span of PC's. However, this must be planned more carefully in order to avoid loses due to (previously bought) small memory chips. Moreover, comprehensive tests should be made (two members of the CSC have contradictory opinions about expected increase of performance) before making a decision about upgrading RAM in a specific type of PC.

3.3.4 Unix Workstations

57. Develop and implement a plan for a gradual replacement of outdated Unix workstations (possibly by cheaper Sun compatible machines).

3.3.5 Printers, scanners, CD writers, display panel

58. Continue the current policy of the systematic upgrade of B&W printers, it works well. Color printers should be available close to locations of their users. A HP Color Laser Jet 5M printer might be a rational choice for affordable color laser technology and B&W printing (as specified in the Plan of April'97). The new generation of Epson color DeskJet printers should be considered as an alternative.
59. Provide a public NT equipped with a scanner, zip drive, and CD-ROM writer in a place where users can sit and work in peace. Necessary instructions/information should be available at the machine to enable and encourage users to work independently. The logging of all CD writer operations is recommended.
60. Review the adequacy of presentation facilities at least once a year. However, the display panel currently used for presentations is currently up-to-date.

3.3.6 Miscelenous

61. Fulfill the several specific requests from the answers to the questionnaire's open questions (e.g. problem with sending payrolls via the modem).
62. Arrange for the regular backups of local PC drives for users who need it (e.g. in the TAP project).
63. Examine and implement the technical possibilities for improving the remote (via modem) accessing of our LAN. In particular transferring mailboxes and other files from ones home directory should be made possible. CS should explore the possibilities for a "complete" remote log-in to our net via modem so that one can use programs such as Eudora.
64. Implement audio conferencing via the Internet should be implemented as soon as it will be a rational alternative to the traditional telephone.
65. Examine the possibilities for the staff being able to personally purchase PC's with the discount we get for our annual PC purchase.

4 Individual statements by the members of the CSC

This Section contains comments, evaluations and recommendations by individual members of the CSC that were either not agreed by a majority of the CSC members or were not even discussed by the CSC.

The individual contributions are included below in alphabetical order of authors without any attempt to make the form of contributions uniform (the only guideline for the individual statements was to keep them within about two pages).

4.1 Comments by Andrei Gritsevskii

I also agreed with most points and recommendations in the CSC Report. However, in some cases my opinion differs. These differences are elaborated below.

1. There is no real reason to belive that UNIX and NT are so incompatible that one of the two operating systems (OS's) should "win" over the other, making the "loser" obsolete. I strongly belive that such a formulation is not productive. Both of the these OS environments are still rapidly developing and improving. For example, the recent UNIX implementation has full Plug-and-Play support and is very rapidly catching up in terms of multi-media futures, which were almost completely unavailable just few years ago. MS has expended a considerable amount of time and effort to develop a UNIX version of IE4.0, and I can hardly imagine that this was done for no reason. At the same time, UNIX development experience has been directly incorporated into NT. Network protocols, support for distributed and high efficiency, high capacity disk systems, security implementation are examples of this. It is very hard to predict the future of either operating system–neither NT 5 nor 64-bit UNIX projects has an exact time schedule or precise specifications–but I would not be surprised to see a product someday that combines both systems, like Open NT, a complete UNIX system environment running natively on Microsoft Windows NT. Open NT 2.1 is a commercial product which is probably just one step away from obtaining a Unix'95 certificate. The current version conforms to POSIX 1 and 2; ANSI C; X11R6; X11R5; BSD Sockets; Motif, and others. I believe that the CSC suggestion of using UNIX for servers and NT for most desktop computers would provide an excellent opportunity for us to benefit from the use of both systems. See also the DC group special report, "NT vs. UNIX: Myth or Reality?" attached to these comments.
2. I am very uncomfortable with the idea of making a CD-ROM Writer-equipped PC available to the public. My hesitation is based on both economic and practical considerations. First, I cannot not foresee a high enough demand for these services to justify allocation of valuable resources (e.g., a modern PC with expensive SCSI card and CD Writer device, which will cost alone at least 7,000 AS). I believe that the currently existing demand directly related to IIASA business can be easily handled by CS. Second, and probably more important, I do not see any efficient mechanism for guaranteeing that such a PC would not be used for unauthorized replication of commercial software or databases. Indeed, easy access to this PC in a place "where someone can sit and work in peace" could lead to just this type of use. The possibility of using a floppy to make an official copy from a product available on the IIASA public network is rather theoretical, given the typical size of a modern commercial tool, but if the CD WRITER device could be used without any, even formal, control, things may move in an entirely different and undesirable direction.
3. With the exception of a few recommendations, the CSC report does not address the issue of maintaining the quality of IIASA PC hardware. This therefore appears not to be a problem for IIASA. However, based on my personal experience and the experience of colleagues, the problem is indeed real and very painful. During my approximately 5 years at IIASA, I have had at least two major problems with hard disks in my PCs (complete crash) and have had two motherboard replacements. Thanks to CS, the problems were solved in relatively short time. Nevertheless, the impact on my work was significant, both in terms of time and frustration. Moreover, I am 100% certain that what happened to my PCs is not an isolated event: other people have experienced similar or worse problems. It is important to have a long-term, on-site support and replacement contract for all PCs. IIASA has this, but it alone is not enough. We should also perform a careful analysis of the technical specifications of any PC that IIASA is proposing to buy before making the actual purchase. It may be that the systems are somewhat more expensive, but the components will be more reliable, which is what we really need.

4.2 Comments by Gerhard Heilig

While I agree with a great majority of the recommendations in this report, I would like to add the following personal statements.

4.2.1 Improvements / Problems

During the last two years IIASA's computing environment, in my view, improved significantly. With the introduction of NT many users were upgraded or got more powerful new PCs. INTERNET access also became faster since we are linked through a new high-capacity glass-fiber line. Finally, with new cabling the IIASA network also got faster and more reliable. However, there are a few problems with IIASA's computing environment, which I consider most critical:

1. the large number of outdated 486 PCs (50% of the stock) which are insufficient for NT;
2. insufficient training in MS-Office applications, especially for secretaries and support staff;
3. a confusingly structured, inconsistently designed IIASA web site with little interactive content;
4. a lack of real high-end PCs for advanced tasks in GIS, data analysis and graphics-intensive programming;
5. the (almost) total orientation towards UNIX as our network operating system;
6. the use of LaTeX as a standard of text processing and publication at IIASA;
7. deficits in technical support for advanced software applications within projects;
8. persisting problems in the CS department.

4.2.2 Recommendations, ranked by priority

While many of the following recommendations are already included in chapter 3 of this report, I would like to rank them by priority according to my evaluation of the survey results and discussions in the CSC committee. I have also added recommendations, which disagree with the consensus recommendations in chapter 3.

1. IIASA should make a substantial one-time investment to replace the 486 PCs with Pentium machines as soon as possible. This is necessary to compensate the aging of IIASA's PC-stock, which is a heritage of neglect in the past. For the future to prevent a fall-back behind the PC hard- and software development it would be necessary to replace our PC stock within 3-4 years. If we assume that some 120 PCs have to be kept up-to-date, IIASA has to purchase at least 30 new PCs annually.
2. IIASA should stop in-house training for MS-Office applications and organize seminars with external trainers - either as intensive in-house seminars or at external training centers. There are excellent courses at various institutions, which have high-quality training materials, hardware and experienced trainers. We certainly need in-house emergency-support for MS-Office applications, but basic training courses would be more efficient with specialized outside partners.
3. IIASA's web site should be improved in the following areas:
   - the site's structure should be re-organized and its hierarchy flattened;
   - all pages should have a consistent design which is both functional and attractive;
   - IIASA scientists should be encouraged and supported to add interactive scientific content, such as databases or interactive models; only high-quality scientific content will attract users in the long run;
   - We should replace our UNIX-based Netscape web server with the MS-NT Internet Information Server 4. It is available at zero cost, much easier to service and maintain than Netscape and supports a larger number of (scripting) languages (CGI, Pearl, Java, MS-Visual Basic, Borland Delphi, DLLs). Only NT IIs4 provides direct connectivity to the most advanced web development tools. (Parts of IIASA's web already run on an NT Server - however on a slow PC).

- Since people from outside complain about IIASA's slow web site we should run it on a high-end Dual-Pentium machine, which would be much faster than our current setup on a slow UNIX server.
- If we do not switch to the NT IIs4 we should at least install MS-FrontPage extensions on our Netscape server to facilitate efficient web page design.
- A complete and unbiased statistic should be produced which shows the number of external requests of IIASA web pages and documents. This should include all types of documents (html, ps, pdf) in all directories (including project directories) available to external users. The statistic should be published on the internal web, to give us a realistic feedback.

4. IIASA should provide at least a few "leading edge" PC-Workstations with large and fast local SCSI disks, up-to-date processor and 21" monitors to those scientists who use PCs for computer-intensive work - such as remote sensing analysis, GIS or advanced graphics-intensive programming. These PCs should also have an external SCSI port, which would make it easy to attach mobile high-capacity hard drives (such as SyQuest 1.5 GB, Iomega JAZZ) for individual backups. Thus people can copy their complete work environment for traveling or working at home.
5. In my view UNIX will be "dead" as a network operating system within the next 5 years. Much more money is currently invested into the further development of the NT Server than into the many dialects of UNIX. To be prepared for the change IIASA should gradually begin to move certain UNIX services to NT.
   - The Name-Server should be moved to a fast Pentium machine to speed-up the log-in procedure for the PCs (the Name Server already runs under NT - however on an ancient 486/33 MHz, which explains why our NT log-in is so slow).
   - We should also run the IIASA web site (or parts of it) on a fast NT web server (see recommendation 3 above).
   - The PC log-in procedure should include an option menu, in which one can select to run the PC as a local machine. This would speed up work for users who (temporarily) do not need UNIX web services, such as network drives. All TCP/IP services that do not need a log-in, such as web browsing, would still function on the local NT machine.
6. Support for LaTeX should be reduced to the necessary minimum. A key-information from our CSC survey is that two thirds of IIASA's researchers and support staff have "not at all used" this program. Of course, people and departments who really need LaTeX, should have access to it. But the Institute should put first priority to improve training and support for the 97% MS-Word users among IIASA's scientists and 90% of administrative staff. In this context I want to emphasize that 87% of the IIASA scientists use MS-Word "intensive" or "often" as compared to 24% who use LaTeX "intensive" or "often". Scientists who only use MS-Word should also not be forced to convert their manuscripts into LaTeX for IIASA publishing. The use of powerful, up-to-date and easy-to-use layout and publishing software, such as QuarkXpress or PageMaker, should be encouraged for the production of IIASA publications. It is incorrect that only LaTeX can process long and complex text documents.
7. IIASA has a reputation for being an Institute where researchers are using or even developing advanced methods of computer modeling and analysis. Unfortunately, only few researchers have reported the use of scientific software in the CSC survey; and only a small group of scientists is actually developing software for modeling or data analysis (Only 4 people reported frequent use of Mathematica). IIASA should encourage scientists to use advanced computer methods by assigning better hardware and additional highly-qualified technical staff (programmers) to those projects that use advanced computer methods. It is important that - as one project leader strongly emphasized - technical expertise is not centralized in CS or some new methodological department, but kept within IIASA's substantive research projects. Modern empirical research uses highly specialized software, such as GIS, demographic projections, optimization models, micro-simulation, etc. These software products can be applied and developed only with substantive knowledge in the field of application.

8. From personal communication with members of the CS in the course of the CSC committee deliberations I understand that - despite the recent changes - management problems still hamper the department's effectiveness. For example, I heard complaints that duties are not transparent and that the workload is not assigned in a fair way among the various staff members. It was also said that the re-assignment of one staff member to Publication has seriously weakened CS's capacity for the support of PC software. While I cannot judge the correctness of these complaints it is obvious to me that serious tensions and frustrations still exist among the CS staff. I would therefore emphasize the necessity to implement the suggestions on transparency and clear task assignment, which we made in the main section of this report (see 2.2).

For me, the most encouraging result of the CSC efforts was the large number of IIASA's staff members who answered the questionnaire. Especially the numerous constructive suggestions and recommendations to the open questions indicate that a large majority at IIASA is motivated to contribute to the improvement of the Institute's computing environment.

4.3 Comments by Marek Makowski

The variety of answers to open questions and comments shared with the CSC clearly show that there is no such thing like a small set of *most important improvements* of our computing environment. Clearly, we do have to make substantial hardware investments but this is only a small (and easily identifiable) part of the needed improvements. It is clear that a lot can be achieved by improving organization and information which will result in both more efficient use of our human (not only in CS) and hardware resources. There are also many little problems that can and should be solved relatively easily. Therefore the CSC has tried to make recommendations that cover all the problems we have been able to identify. There are no priorities for recommendations simply because there is almost always a trade-off between an importance and a cost. I think that all the recommendations should be implemented but a sequence of implementations will depend on the availability of resources. This will be much easier if we work in a spirit of a small scientific community and treat the CS Dept. as a team of colleagues who are a part of our community (and not as a service that is supposed to meet all needs and additionally be blamed for problems caused by design flaws of over-advertised software).

I want to comment in more detail on two topics and to provide few additional recommendations.

4.3.1 Scientific computing

Scientific computing at IIASA was originally the main topic defined by the Director for the CSC. The two related questions were: *do we use up-to-date software tools? how can we better educate ourselves for efficient use of computing?* The following comment illustrates the problem from a perspective of a researcher: *Reset priorities towards support and enhancement of scientific applications/programs. The fact that point 7 made it to this survey*[4] *is the ultimate proof that IIASA seems to have lost any idea about its scientific mission (after all, everything can be done in Word and Excel???).* Neither this comment nor comments requesting programming support were considered important enough to be included in the analysis of open questions (while the use of cellular phones was considered as one of the most interesting suggestions !). I am sorry that I have failed to convince colleagues who made the analysis to extend it in order to adequately cover issues of scientific computing.

The CSC agreed that scientific computing should be improved, but our recommendations are clearly driven by the needs of the office-type applications. This would be right if IIASA's main topic was, say, Medieval History. However, a large part of our research activities requires up-to-date computing. Moreover, over past years IIASA has built up a reputation in developing and

[4]Use of Unix and possible replacement of Unix by NT - MM.

using advanced methods for scientific computing. Unfortunately, we are loosing our competitive advantage in scientific computing because:

- our methodological research (related to scientific computing) has been substantially reduced.
- the development of methods and tools for model building and analysis is a fast growing field and our use of standard tools (like Matlab, Mathematica, various modeling languages, data management analysis, modern programming languages) is below the level of a master course at a good university.

The above quoted question *"everything can be done in Word and Excel?"* is an exaggeration today, but it soon may become a sad (but true) characteristic of our computing unless we make a substantial effort to catch-up with a reasonable level of scientific computing pretty fast. We definitely have to undertake much more than is suggested by rec. no 32 and 33 (cf page 14).

As already stated in Section 2.1, computing expertise within a project (as opposed to relying on computing support provided by the CS) has been (and continues to be) justified by the needs of a project for having reliable and flexible computing support. Several colleagues in such projects are using advanced methods and tools, but they do not have time to promote such methods and they do not have much time for the intelligence of new methods and tools. Keeping enough computing expertise and human resources in projects that apply advanced computing is a necessary but not a sufficient condition for reaching a reasonable level of scientific computing at IIASA. Moreover, for most projects a development of such an expertise is not rational.

A few years ago IIASA has changed its policy towards scientific computing that used to work for many years and which had built our reputation of an institute with strong methodological and computing abilities. That is, we have stopped the programming and modeling support that used to be provided by the CS and we have drastically decreased those methodological activities that were oriented towards scientific computing. If we honestly and objectively consider the situation, we have to admit that this change of policy results in fast increasing the gap between the up-to-date and our level of scientific computing. An additional negative effect of our current policy is the lack of programming support for administrative departments (which worked so well in the 80's).

I am convinced all projects will profit, if we will substantially improve the level of our scientific computing. There is no rational reason to believe that the situation will improve, if we will continue our current policy (which practically means that projects can't get any support for scientific computing). I am convinced that rec. 66, 67 and 67 (cf below) are an absolute minimum of actions that must be taken.

4.3.2 Unix versus NT

In addition to the technical arguments (cf Section 2.4.4) I summarize some of the market-type arguments:

- Unix had been considered to be a dead-end by IBM and Digital (IIASA was a rather unique place running Unix on PDP) already in the early 80's. Everyone knows how fast and drastically IBM and DEC changed their attitude towards Unix.
- We all know that a huge amount of money is being invested in the development of NT. However, even huge resources do not guarantee success: IBM stock prices in 1987-1993 (from $175 down to $42) clearly illustrate this point. Moreover, a number of well established companies are investing also in Unix.
- Unix is no longer a more expensive alternative to NT. If one calculates all costs (including licenses for each user, upgrade [on average every second year] of both software and required hardware, direct and indirect cost of support [every new version is more difficult to use and requires more resources for support]), then using NT is pretty expensive. On the other hand, Unix (especially for Intel machines) is becoming cheaper (there exist versions of Unix that are cheaper than NT).

- Many decision makers have good reasons to prefer Unix over NT. We have heard from Gerhard that e.g. *the Chicago stock exchange ... has completely switched its trading system from UNIX to Microsoft NT*. Therefore let me give a related example of the Warsaw Board of Trade (which was organized in 1997 in cooperation with the Chicago and London Boards of Trade). The coorganizers clearly recommended Unix (which runs both on Sparcs and on Intel machines) for the OS. The main arguments were: reliability, costs and experiences of other boards of trade (e.g. the Project A of Chicago Board of Trade (automated trade) as well as all basic services used by various boards of trade run on Sparcs).

I've summarized the additional arguments about Unix and NT in order to justify my recommendation (cf rec. 70 below) for keeping our heterogeneous and balanced environment composed of Unix and NT and to avoid wasting our scarce resources for experimenting with NT (cf rec. 71 below). I have no personal reason to prefer one OS over the other. My reservations against becoming too much dependent on NT is based on experience of intensive use (for various types of applications) of both Unix and NT and on my knowledge of operating systems in general. Moreover, I don't know of anyone having a background in computing sciences and good experience with both Unix and NT who would recommend to replace Unix by NT.

4.3.3 Recommendations

My additional (to those given in Section 3) recommendations:

66. Gradually reset priorities towards support and enhancement of scientific computing.
67. Re-establish a position in CS (or with a methodological project) for a staff member with a background in applied mathematics and computer sciences and provide *a kick-start* type of support for scientific packages (such as Matlab, Mathematica, selected modeling languages, expert system shells).
68. Keep expertise in the CS and provide programming support (at least consultations) for up-to-date programming languages (C++ with STL, Fortran90) and software quality tools (like Purify, BoundsChecker).
69. Define scope and rules for the CS programming assistance at a more involved level for projects and departments.
70. Keep the heterogeneous Unix/NT computing environment, but ensure a balance between resources and support allocated for each of them. In particular, improve support and training for Unix to reach the level of support for NT.
71. Don't use NT for any service that is accessible from outside of IIASA. Don't spend resources for experimenting with NT servers for services that currently run on Unix.
72. Re-establish a pool of PC's and Unix WS for visitors and short term staff.
73. Provide support for making software distribution (installation) kits.
74. Install a utility which will keep time on Unix systems synchronized with the universal time.

Acknowledgment

The CSC would not have been able to prepare this report without the support of many of our colleagues. It would not be practicable to mention all those who have helped us, therefore we will only summarize the following:

- Almost all of the departments and projects were represented at the meetings we organized.
- The Head of and colleagues from the CS Department provided us with a lot of valuable information.
- A 135 colleagues responded to the questionnaire and many of them gave additional comments and suggestions.

The CSC wishes to express sincere thanks to all colleagues who were willing to take their time and to help us to better understand problems and suggest possible improvements of our computing environment.

A Appendices

A.1 Analysis of PC hardware distribution at IIASA

by Gerhard K. Heilig

According to information from CS, which was submitted to the CSC committee, IIASA has 181 Personal Computers, ranging from an ancient 486 with 25MHz to Pentium 180 MHz machines (situation as of January, 29, 1998). The Institute currently has 220 staff members, which includes 182 regular employees, plus associates and guest scholars. Since some of the staff members are part-time and since associates are here for only up to six months, one can conclude that the number of computers approximately matches the number of concurrently present IIASA staff members. This impression seems to be even more obvious, if one takes into account that several people primarily use UNIX workstations. The number of available PCs could be only a problem during the YSSP period. However, it is not the number of PCs but their quality, which is critical at IIASA.

The low-end machines

More than half of IIASA's 181 computers are outdated: there are 93 non-Pentium PCs - most of them 486 machines with 33, 50 or 66 MHz (see table 7). We even have two 25 MHz 486 PCs that probably could get us some money from a computer museum. According to information from CS 12 of these low-end 486 PCs are basically unusable. They cannot be upgraded to meet MS-Windows 95 or NT minimal requirements, because spare parts are no longer available. A few of these machines, however, are still used for technical applications (telephone system logging)which require DOS. The 50 and 66 MHz machines have been upgraded to 24 MB of RAM and 1.3 GB hard disks to make it possible that the NT operating system could be installed. Even with these upgrades the machines are extremely slow with modern office software such as MS-Office 97. On a 486 with 50 or 66 MHz it is almost impossible to run an e-mail reader, a web browser and a standard Office applications (such as MS-Word or Excel) at the same time. Upgrading of these low-end 486 machines does not make any sense, they should be replaced as soon as possible.

The "high-end" machines

At the moment IIASA has 25 Pentium Pro PCs with a processor speed of 180 MHz. These machines, which represent the "high end" at IIASA, are at least two generations behind the current state of the art. They are outdated because of the following reasons: (a) Intel has announced the termination of the Pentium Pro processor family by the end of 1998. A newer processor design (Pentium II) has become the de-facto standard. (b) Pentium Pro processors were (and still are) available only up to 200 MHz, while the Pentium II series is already on the market with 330 MHz versions. Much faster Pentium II processors will be available soon. (c) IIASA's Pentium Pro machines have relatively slow IDE hard disks; (d) the video board is at least one generation behind the current standard; and (e) they only have 17" monitors. Today, a top level PC would be a Pentium II with 330 MHz, 64 MB parity SRAM, and 9.6 GB Ultra-Wide FAST-RAID hard disk array, AGP Graphic Card and 19" or 21" monitor (this is, for instance, a standard configuration of the new Hewlett Packard Kayak XU PC series). While IIASA's Pentium Pro machines are clearly not up-to-date for computation- and graphics-intensive tasks, such as GIS or the processing of remote sensing information, they are still well suited for standard office applications (such as MS-Word, MS-Excel, MS- Access, MS-PowerPoint). When they have enough RAM memory (48 - 64 MB) one can easily work with three or four programs open at the same time. They are also powerful enough for many scientific applications in modeling and (statistical) analysis. Researchers have successfully used statistical (SPSS, SPlus) and mathematical packages (Mathematica, Matlab) for highly demanding tasks with these PCs.

The "middle-range" machines

IIASA's middle-range machines are 63 Pentium PCs with a processor of 90 and 120 MHz. The group also includes three relatively modern Pentium 133 laptops. RAM memory and hard disk space in these machines varies according to user, but usually only 24 MB RAM is installed. On average these machines are 2-3 years old. For these middle-range PCs there is an easy, cost efficient upgrade path: RAM memory. As numerous tests have shown RAM upgrades deliver the greatest return in speed increase with the lowest price. By upgrading these machines to 48 or better 64 MB RAM one could increase their usable life-span by one or two years. In my view there is no question that 24 MB is inadequate for running typical MS-Office applications under Windows NT. Technically, RAM upgrades would be no problem for most of these PCs. The 90 MHz Pentiums have standard DRAM banks, only the 120 MHz machines have parity DRAM (which is more expensive). In a few cases it would be necessary to replace already installed RAM modules due to the lack of free banks. But, according to information from CS, these are only few machines and the replaced memory could be used in other machines.

Type						Total
Low-end	486/25 2	486/33 10	486/40 1	486/50 5	486/66 75	93
Medium-range	Pen/90 35	Pen/120 25	Pen/133 3			63
"High-end"	PenPro/180 25					25

Table 7: Distribution of IIASA's PCs by Type

The greatest need

It is, of course, a highly sensitive issue to make any kind of judgement, who is in greatest need for a hardware upgrade. The easiest approach to this problem would be to avoid any clear statement and discuss only procedures or formal responsibilities. I believe the available information on PC deployment allows more concrete conclusions:

- First, one can identify at least 7 project secretaries, who have highly inadequate PC hardware (usually 486/66 PCs). They often have to process long and complex documents (working papers, publication manuscripts, etc.), which might include many tables and charts. Some projects have documents with embedded maps and satellite images, which can be multi-megabyte bitmap files. The hardware available for these task is clearly inadequate. It is almost impossible to process a long document with embedded (or linked) charts on a 486/66 MHz machine under MS-Windows NT with just 24 MB of RAM.
- Second, there are at least 6 IIASA staff members in the administration who have to conduct computing-intensive work, but have low-end 486 PCs with 66 MHz. These are, for instance, staff members, who prepare our payroll, do the typesetting for IIASA publications, conduct literature searches, or have to design and edit the IIASA web page.
- Surprisingly, there are also a number of project leaders and research scholars who only have 486 PCs. Two or three of them might work primarily on UNIX workstations and thus have less need for a more powerful PC, but it is hard to imagine that for the others this level of hardware is adequate.
- Among the IIASA staff members with Pentium PCs one can identify several who would certainly benefit from more advanced machines. These are research scholars and administrative staff members who use their PC intensively for programming, graphics-intensive work or statistical and mathematical analyses.

Conclusion

Despite the large number of PCs (181) the situation of desktop computing is actually quite tense at IIASA. More than half of IIASA's PCs is clearly beyond their usable life-span and the rest are only medium capacity PCs as compared with the current state of art. If IIASA can only upgrade 25 PCs per year it will take another 4 years before the Institute is completely in the Pentium age. The situation is most urgent for some 25 staff members, who have computer-intensive tasks, but only 486 machines. These staff members should get Pentium machines as soon as possible. I also see a deficit of real high-end machines, which could increase the productivity of scientists who develop software and models or work with GIS data. A great problem with IIASA medium-range Pentium machines (90 and 120 MHz) is their insufficient RAM (typically 24 MB). Experience has shown that one can only work efficiently with MS-Office applications under Windows NT if the computer has at least (!) 32 MB. The typical work situation of a secretary requires that several software packages are open at the same time for cut-and-paste operations - such as Eudora e-mail, MS-Word and a graphics package for editing charts. Under these conditions 24 MB are usually not sufficient to prevent swapping to the hard disk, which slows down the work enormously. Since we have to live with these Pentium machines for some time I would strongly recommend to upgrade their RAM to between 48 and 64 MB.

According to the current PC hardware situation a three-fold upgrading strategy would be most appropriate for the next rounds of hardware upgrades:

1. First, we should try to replace IIASA's large number of 486 machines as soon as possible. Upgrading these machines to the minimum requirements of running MS-Office applications under Windows NT is either impossible or cost-inefficient. This needs a one-time investment in addition to the regular purchase of new PCs for keeping the stock up-to-date.
2. Second, I would estimate that IIASA has to keep a stock of at least 120 PCs reasonably up-to-date, so that no machine in that stock is older than 4 years. This would require that some 30 PCs are replaced with new machines on an annual basis. Otherwise the Institute would not be able to keep up with the rapid technological change in the hardware and software sector. The serious aging of IIASA's PC hardware in past years was du to lower than necessary annual purchase rate of PCs. If the institute needs a larger stock of up-to-date PCs, or if we want technologically more recent machines, the annual turn-over rate would have to be increased even further.
3. A small number of IIASA staff members (around 5) uses the PC very intensively for programming, graphics-oriented and GIS work or demanding statistical and mathematical applications. The Institute could boost productivity of these IIASA staff members by providing them with state-of-the-art high-end PCs (such as currently Pentium II with 330 MHz, 64 MB RAM and 9 GB hard disk, and 21" monitors).
4. Memory upgrades for our existing pool of Pentium 90, 120 and Pentium Pro PCs would most cost-efficiently increase their usable life span, until they will be replaced by more recent machines.

February 19, 1998.

A.2 Analysis of the open questions

by Gerhard K. Heilig & Daniel Wendt

The following is an analysis that summarizes the responses to the open questions in the CSC questionnaire; a full documentation of all responses is included in attachment B of this report. We have focused only on those responses, which we believe are most significant for IIASA's future computing environment.

The analysis procedure involved the following steps: First, we compiled a complete list of all suggestions and comments and split them into individual items. This was necessary because several respondents had submitted long texts with multiple suggestions. In a second step we grouped these individual items and suggestions into categories. Finally, we summarized the responses for each of the categories. The process obviously involves an element of evaluation; and those who would like to make their own evaluation can always go back to the complete documentation.

The analysis of the open questions in the CSC questionnaire can be summarized as follows:

Upgrade of PC hardware

In our view, the dominant suggestion among respondents to the CSC questionnaire was that IIASA should upgrade the PC hardware. More than 50 individual items dealt with insufficient PC hardware. In many cases users directly identified the problem. One user, for instance, wrote:

> To improve the Desktop Hardware Situation ... is the most important point... We at IIASA actively run machines of up to 6 years age. And more than a third of our complete desktop machine basis consists of 486 machines. We are facing a growing number of users, who cannot complete their tasks in a straight and efficient way, simply cause their machines are too weak.

Very often users also mentioned problems in their day-to-day work, which directly emerge from insufficient PC hardware. Here are two typical responses:

> We need "speedier computers for everyone. I can't really use Corel Draw or Adobe, because there is not enough Ram (this is what I understand), and everything is MUCH TOO SLOW" (Capitalization by respondent)
>
> "Many of us are working with archaic hardware, running under NT, and expected to work with all the various MS office software packages, as well as Netscape, Eudora etc, which as you know is tough with only a 486 sitting on your desk... I have found it extremely difficult over the past half year at times to work effectively and efficiently with the hardware which is at my disposal."

Several users are obviously so frustrated with the PC situation at IIASA that they brought their own PCs to the office. One of them wrote:

> "More than just the minimum requirements for hardware should be put on the machines. I use memory-intensive programs that use both a lot of hard-drive space and RAM. For this reason, I brought in my own computer, since I wasn't easily and quickly getting what I needed on IIASA machines."

Closely related to the PC hardware problems, complaints were also made about other desktop-related hardware, such as CD-ROMs, monitors, or scanners. A typical response was the following:

> "An increasing number of databases, etc., are available on CD-ROM. Because most of the computers here (at least in POP) do not have CD-ROM drives, this is a potential problem."

Training & Hands-on Software Support

We found contradictory statements about the quality of CS software seminars in the open responses to the CSC questionnaire. Many respondents were clearly critical, while a few others praised the usefulness of these seminars. For instance there were the following user responses to what would be the most important improvement:

> "Above all, better quality of training: the 2 courses I attended (Access and NT) were a complete waste of time. The Access course was far too technical for my purposes, the NT course was a lecture without any hands-on training."
>
> "I think some more "hands-on" training courses – and much more frequently – would be a great asset."
>
> "more solid training of secretaries (e.g. two-days, hands-on courses) would improve in-house efficiency"
>
> "Introduce Training for Software - Training for Software is basically non existent; if it exists it's at such a low level that it does not help the user too much."

> "more training sessions like the two one hour seminars we had in November and December (Access and NT)."

While there was disagreement in the overall evaluation of CS software seminars, a great majority of users emphasized the need for more - especially for more practical - software training. In the open user responses to the CSC questionnaire the words "training" and "hands-on" were used more then 70 times. In our opinion it is quite clear from the responses to the CSC questionnaire that users are not happy with theoretical, "front-of-the-room" instruction. This is especially true for core PC software - such as MS-Windows NT operating system and the applications of the MS-Office package (MS-Word, MS-Excel, MS-PowerPoint). IIASA's staff members want these seminars to deal with everyday problems. Some users explicitly demand that hands-on training and support should be given individually when they have a concrete problem. Users also complained about a lack of information about which software is available at IIASA and how it can be used. Here are statements from five staff members:

> Better support for frequently used software (seminars on what is new and how to efficiently use it, clear assignment of responsibilities for support (assistance including hands-on training, troubleshooting). Such an assistance should also be available for advanced users.
>
> "I would like a basic training course in the use of windows and Eudora as I have no idea what all the icons, bookmarks, etc., do – having never had a lesson and only learned from what various people have taught me over the years. Being a computer idiot: hands-on training would be preferable."
>
> "I think that more training in general office software (Word, excel, access) should be offered."
>
> "... continue (more improved) in-house trainings and up-to-date hand-on. adequate unit(s) to suit worker's needs."
>
> Most important improvement: "Training and support to encourage professional-level Excel spreadsheet modeling and report writing (Word, graphics packages, page maker, etc.)"

The answers to CSC questionnaire indicate that most users are relatively happy with the quality of software and hardware support. Several user responses expressed their appreciation for fast and competent support when they have a software or hardware problem. A few negative statements only complained that the support staff would not always be reachable.

Requests for UNIX

A small, but significant group of IIASA computer users strongly requests access to UNIX workstations and specific UNIX services and programs (LaTeX, for example). This group is very much concerned that IIASA might completely switch to NT (also on the servers side). These mostly scientific users consider UNIX-based programs and services as critical for their work. Especially people who use computing-intensive numerical programs (optimization) request ongoing support for UNIX on the servers and UNIX workstations.

Several users also explicitly requested ongoing support for LaTeX (which is mostly used under UNIX).

> "scientific publishing without LaTeX currently is inconceivable + retaining a comprehensive suit of standard public-domain Unix software is very important for external compatibility"
>
> "We use Unix very often for Latex, therefore I would prefer to keep Unix."

One user indicated that "Scientific WorkPlace" might be an alternative to traditional LaTeX.

> "If IIASA can install "Scientific WorkPlace", it would let everybody have access to LaTex, and would help reseachers to save time and energy a lot. Scientific WorkPlace is much more user-friendly than tranditional LaTex."

Access to UNIX workstations is also needed for the GIS work, partly du to the lack of high-end PC hardware, but also because IIASA does not have PC-versions of certain GIS packages.

> "Regarding dismiss of Unix and move completely to NT If this is done we would need much stronger (!) PCs + large screens for the PCs Further I hope under NT I could use all the Unix commands, otherwise I would have big difficulties in moving."

> "The greatest barrier I have to moving completely to PCs and windows from UNIX machines is GIS. I know ARC-INFO is now available for PCs, but as far as I know the full ARC-INFO for PCs is not yet available at IIASA. This is a product that should certainly be available."

Server-related Problems

Several users had problems or suggested improvements for our network server infrastructure. The main concern was that our outdated servers, can hardly carry the load of usual network services. Users, who depend on these servers for running applications, experienced significant slow-down in periods of heavy use. Users suggested the purchase of specialized file-servers, which could take the load of conventional net services from the servers, so that there would be more resources available to people running applications.

> "Improve the network to reduce response times and waiting times for loading data etc."
>
> "I would VERY MUCH appreciate a fast way (e.g. line-mode unix and DOS-WIndow) command to find the telephone number of a Staff member (since we don't get phone books any more)."
>
> "Explore networking devices/facilities further. Esp. communication (voice/picture) and tools for "collaborative" writing."

Policy statements

A small number of comments were interesting to us, because they dealt with "policy statements" concerning computing-related procedures. We received a clear message, that some people felt unfairly treated by the assignment of PC hardware. Several responses indicated that better computers should be assigned according to real need not hierarchical status. A respondent suggested that Project Leaders have not always shown - or were not allowed to use - the best judgement in assigning the most powerful machines within a project:

> "I think the secretaries and other support staff need to have better PCs. We spend most of our time working on the PC, and faster, more efficient usage would be advantageous. And the decision to give the support staff better equipment should not only be the responsibility of the Project Leader or Dept. Head, since they often have other "agendas" in mind."

On the other hand it is interesting that a few project leaders actually have much less powerful PCs than their secretaries or the researchers in their projects (this is a result of our analysis of PC distribution). This might indicate that greater transparency in hardware distribution ("who really has the good machines") could eliminate irritations by those who feel that they were not given adequate machines.

Other suggestions for improvements

There were a large number of other suggestions for improvement - often specifying in great detail what and how things should be improved. This indicates that IIASA staff members are interested and motivated to contribute ideas for the improvement of IIASA's computing environment. We cannot list all individual suggestions (please check the full documentation), but would like to focus on a few items we found most interesting:

1. It was suggested several times to improve IIASA's color printing capacities. Our current HP Color printers are medium to low end - much better hardware (such as from Epson) would be available for very low prices. There is also a problem with the access of color printers, especially when they are used for overhead transparencies. One user vividly describes the difficulties he experienced when trying to print color transparencies.

   > "I think that each project should have its own colour printer, located somewhere close to the people who need it. There is an unbelievable amount of time wasted at present in getting to the nearest colour printer, only to find it : (a) out of action (i) because of some fault or interruption (ii) because of lack of paper; (b) busy (i) needlessly ejecting pages of rubbish from an inappropriate file (ii) printing dozens of black & white pages from the Web; (c) moved without warning to a new location."

2. Several users indicated that they would like to make better use of the web - by implementing special project web pages, using it for collaborative papers or designing interactive content (data base access, models). However, they would need better hardware, training and support for this effort. Here are responses from two users:

   "I agree that the Web is a most important part of the future of communications – and we, at IIASA should be in the forefront of presenting the Institute as effectively as possible. I think this means that more of us should be in a position to make concrete contributions – and this means hands-on learning, both about html, and whatever editing program might be used on an Institute-wide basis (FrontPage, as far as I know)."

   "One problem are computer facilities. Our secretary ... has no powerful computer that she could use FrontPage."

3. One person suggested a simple cost-efficient solution to significantly improve the reachability of CS-service staff: two or three cellular phones for the people who are constantly moving around for hard- and software support. This should work much better than the current hot-line, which is not staffed with a technically experienced person. The user response was:

   "CS should have handies, so that they can be reached more easily"

4. Power failures are not rare in Laxenburg. They are not just annoying for PC and workstation users, but can actually lead to serious data loss when servers cannot shut down properly. Users therefore recommended un-interruptable power supplies (UPS) for the servers.

A.3 Comments to the analysis of the open questions

by Marek Makowski

The CSC questionnaire contained two so-called open questions ("what is the most important improvement of our computing" and "comments"). We have received 131 non-empty answers to both questions and all the answers have been used for the preparation of the report.

The analysis made by Gerhard Heilig and Dan Wendt (cf Appendix A.2) was focused on those responses, which the authors *"believe are most significant for IIASA's future environment"*. Therefore a number comments which other members of the CSC consider to be significant (or even more significant than some of the comments included into the analysis) were not covered by this analysis.

The CSC has decided to refrain from writing another analysis. Instead we list below types of comments that other members consider important and which were not covered by the analysis. We don't comment here on few conclusions formulated in the analysis that were not shared by the CSC because all the agreed conclusions and recommendations have been included into the report.

Here is the list of examples of comments that other members of the CSC would have covered by an analysis (the texts in *italics* are quotations from the replies to the questionnaire):

1. *Reset priorities towards support and enhancement of scientific applications/programs. The fact that point 7 made it to this survey is the ultimate proof that IIASA seems to have lost any idea about its scientific mission (after all, everything can be done in World and Excel???)*
2. *CS Programing Support*
3. *We need (1) more support with scientific software, (2) better compatability with home computers, (3) an institute pool of laptops*
4. *CS should provide expertize in modern tools for modeling and programming and with Oracle. Standard public domain tools (like Gnu) should be maintained up-to-date. Majority of forms should be moved to Oracle (with Web based UI). Web should used in more organized and rational way. Address DB and organization of conferences should be implemented on the Web a.s.a.p.*
5. *Programming support to make the most of the soft and hardware which is currently available. I am convinced that current utilization level of the power of our present resources is very low. For adminsitrative applications there is an immense potential which could be realized were we to have (and keep) a person continually introducing and improving data base applications.*

6. *Myself, for example I would be very happy if I could have: *) An introductory course into SPSS (followed by a more advanced course later) ... *) A person who I can specifically adress when I've any questions in C++ (maybe even some training in C++),*
7. *Restoring the support for Unix to its previous level,*
8. *more training for newcomers, especially on Unix.*
9. *more information, more transparency*
10. *Have CS discuss with each user what the users really do, decide what the best software is to meet those needs (ensuring as far as possible that people are using compatible applications for similar jobs, to save conversion), and actively train users.*
11. *The scope and priorities of the CS support should be well defined and known. ETA for fixing a problem should be specified quickly. All reported problems should be reliably fixed (some requests are "forgotten", which spoils the image of CS - most of the CS staff work efficiently, hence cases of un-reliability should be eliminated).*
12. *It would be useful to have some means of sharing information, documenting solutions to problems, tips, etc*
13. *A greater comunication and coordination regarding the software, between the individual departments and CS may be useful.*
14. *It is strange that most of our necessary software packagies we had to buy privately as Symantec C++. I would appreciate an improvement in the software purchase policy. - We are missing a CD-writer.*
15. *Without Joerg and Martina I think that CS is understaffed.*
16. *Publications Catalogue needs to be upgraded*
17. *If a software will be installed, it has to be uniformed or all alike to everyone.*
18. *I thing that our file servers and also workstations have to be upgraded. Most of them are more then four years old and not adequat at all*
19. *faster server or an SP machine*
20. *I'd like 1. occassional access to a really fast machine 2. dial-up access from home 3. more flexibility in backing-up my files 4. a comfortable (ergonomic) keyboard with a touch pad.*
21. *Improve Web support at IIASA: 1. actively assist the scientific projects to enhance their Web presence 2. offer better support and expertise for Web programming (Java, JavaScript, VRML, cgi)*
22. *90% of my computer-related frustrations are due to software design (Windows, EXCEL, etc)*
23. *The WindowsNT environment seems unusually unstable.*
24. *There are big problems using the modem for sending payroll to IBM. CS knows about this, and I don't understand why this can't be fixed.*
25. *Continue to maintain a policy of trying to keep up with new technologies, but at the same time make the best use of what we have currently.*
26. *Each new generation of software demands better and faster hardware, which in turn, grows obsolete alarmingly quickly. ... A deliberate Institute policy to settle for stability (i.e. not change soft and hardware with each generation), may be desirable and advantageous both in terms of support manpower and of computing environment stability, in addition to helping the budget situation.*
27. *+ current CS support for electronic processing and standardization of IIASA's Interim Reports is insufficient + retaining an up-to-date Unix environment currently is vital + acquisition of an up-to-standards, high-performing server is desirable to allow for complex simulation tasks + stability of Windows 'workstations' is insufficient and causes serious inefficiencies + retaining a comprehensive suit of standard public-domain Unix software is very important for external compatibility + electronic in-house forms should be inplemented without more dawdling*
28. *The central address database is unusable for me.*

Additionally, there is a number of requests for scientific software that should have been analysed.

One of the topics covered in the analysis, namely Unix has a wrong selection of comments. Requests for LaTeX were included as major arguments for continuation of Unix. However, LaTeX support is another topic, and the requests for Scientific WorkPlace illustrate rather needs for a better support of LaTeX on NT than a need for Unix. There is a number of other comments related to computing needs that better illustrate the need of Unix.

B Attachments

The following attachements are included with the hard-copy of this report:
1. List of PC (provided by the CS)
2. A copy of the proposal by G. Heilig of April 7, 1992.
3. A copy of the IDS opinion *"NT vs. Unix: Myth or Reality?"*

The following attachements to this Report are available on the Web[5]:
1. Summaries of answers (except of answers about software and to open questions).
2. Summaries of software use, adequacy and support (items specified in the questionnaire).
3. Summary of additional software (items specified in the additional software fields, sorted and commented by Andrei Gritsevskii).
4. Additional software (raw data of items specified in the additional software fields).
5. Answers to open questions (automatically generated list of not formatted non-empty entries).
6. Answers to open questions (list prepared and formatted by Gerhard Heilig).
7. List of login names of persons that filled in the questionnaire.

[5] At URL: `www.iiasa.ac.at/~marek/csc`