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PROGRAM COMPLEX FOR AUTOMATED COLLECTING, STORING AND ANALYZING HARDWARE INFORMATION FOR THE CLIENT PCs IN THE **NICE** ARCHITECTURE

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Introduction

CERN has a large number of PCs, currently >3500, used for administrative, engineering and scientific tasks (see figure 1 which shows the number of concurrent users in a typical week, which is typically 15-25% lower than total number of users). The PCs connect to central servers for running applications and to access and share data. However, whilst the servers are managed centrally, the PCs belong to people in many different divisions and are spread over a large campus in two different countries (France and Switzerland). In other words, the servers are managed centrally but the client PC usage is very distributed.

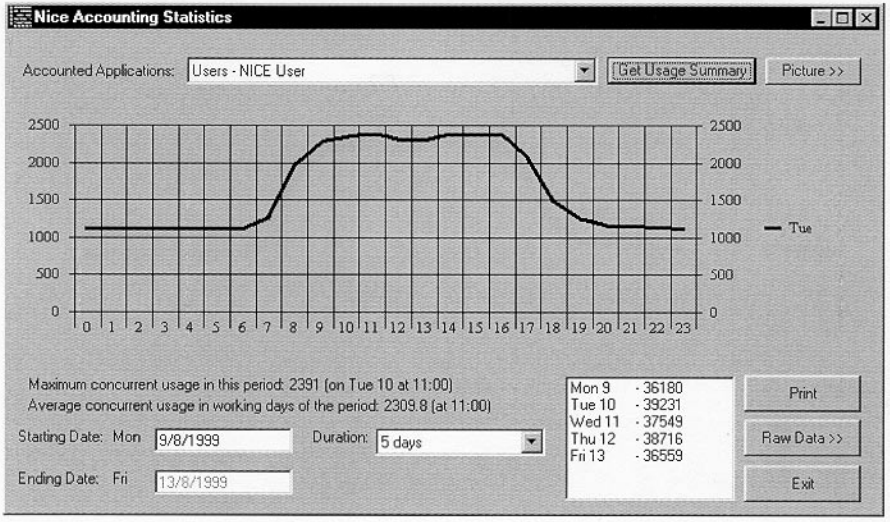

Figure 1. NICE accounting statistics for a one-week period

In order to make it possible to provide central services, we must know who are

our users. We need to maintain up-to-date, reliable figures of who uses what. This applies to both software and hardware. It is virtually impossible to do this work manually, given the number of PCs and the rate of change (figures for the last 2 years are approximately 1200 new PCs / year).

The information obtained by collecting information about all PCs is called a ***hardware inventory***. The process of collecting information about software usage is covered by other tools, and therefore not described here.

The hardware inventory of the client PCs serves several purposes:

- If we upgrade or introduce new client applications, we must know if the PCs will still operate in a reasonable manner (enough memory, fast enough CPU, how many PCs have high-resolution monitors and so on).

- Plan phase-out of old PCs (typical life-time 3-5 years)

- Plan hardware upgrades for major changes (for example transition from Windows/95 to Windows/2000)

- Statistics for the management, like overall trends (number of PCs per different platform, rate of change) which ultimately will influence allocation of manpower for support, outsourcing contracts and so on.

The first hardware inventory for the CERN PCs was introduced in 1992-1993, made by the NICE divisional representative Chris Andrews. It was developed when the client PCs were running DOS and Windows/3.x and was used until 1998 with only minor modifications.

The tool was very rudimentary in the sense that it did not keep any information about hardware. The tool had instead to use the so-called BIOS level or even try to access the hardware itself to enumerate the components available in the PC. However, the information available from the BIOS is very limited, for example information about network card, CD-ROM and graphics adapter is either completely missing or incomplete.

The introduction of Windows/95 and Windows/NT 4 opened up new possibilities. These platforms are "real operating systems" and take active part in managing the hardware components themselves (although Windows/NT 4 is not Plug & Play). In this context, it is appropriate to have an inventory program which asks the operating systems which hardware components are installed. An application that can talk natively to the operating system is called a WIN32 application (Windows 32-bits application).

The hardware inventory can be divided into two parts:

- collecting data from the client PC
- storing it in a central database on a server.

Client

The inventory program is called *InvPC.exe*. It collects information by using Windows API calls, running other system tools, and processing information from the registry. The program is written in the C language. On the NICE[1] local computers the program is automatically ran by a special facility described later on. See figure 2 for a typical example of output from InvPC.exe.

[1] http://nicewww.cern.ch/homepage/home.htm

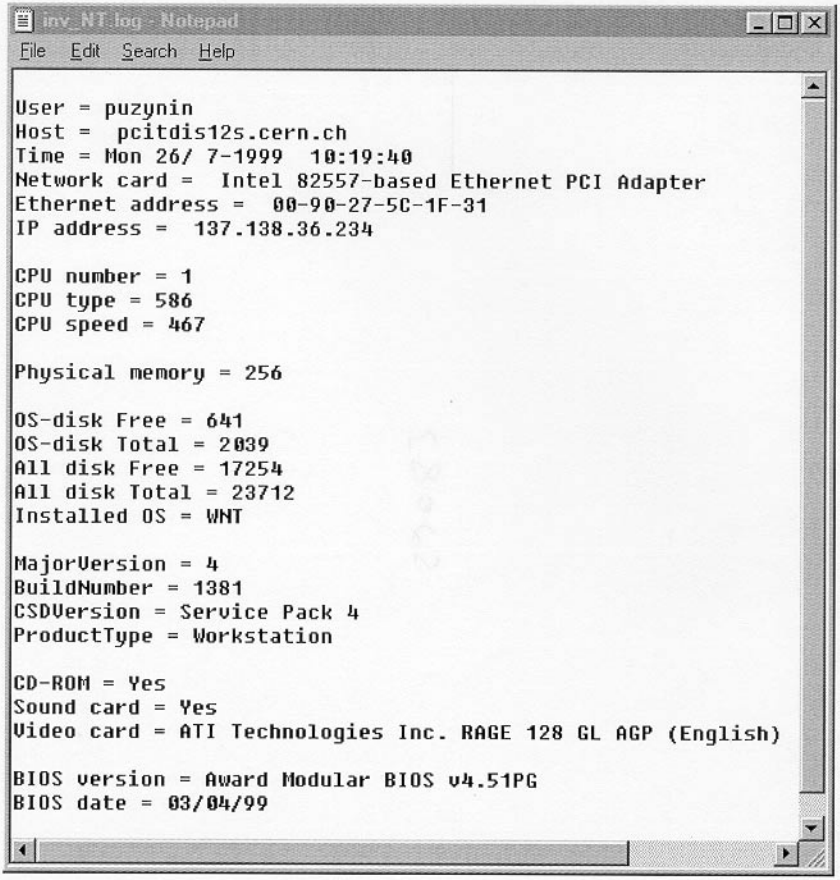

Figure 2. Example of output from InvPC.exe

The parameters "*Major Version*", "*Build Number*", "*CSD Version*" and "*Product Type*" are important for Windows/NT platform only.

- The "*Major Version*" identifies the major version number of the operating system. For example, for Windows/NT version 3.51, the major version number is 3, and for Windows/NT version 4.0, the major version number is 4.
- The "*Build Number*" identifies the build number of the operating system.
- The "*CSD Version*" indicates the latest Service Pack installed on the system. If no Service Pack has been installed, the value is empty.
- The "*Product Type*" identifies the commercial product type, Server or Workstation, which are sold as two separate products.

The information about the CPU speed is present in the registry for the Windows/NT platform (see figure 3). However, it is impossible to retrieve this information on the Windows/95 platform (no support from API functions or the registry). Adding a benchmarking function to InvPC.exe could solve this problem but is not currently implemented. Therefore, the CPU speed on the Windows/95 platform is always set to zero.

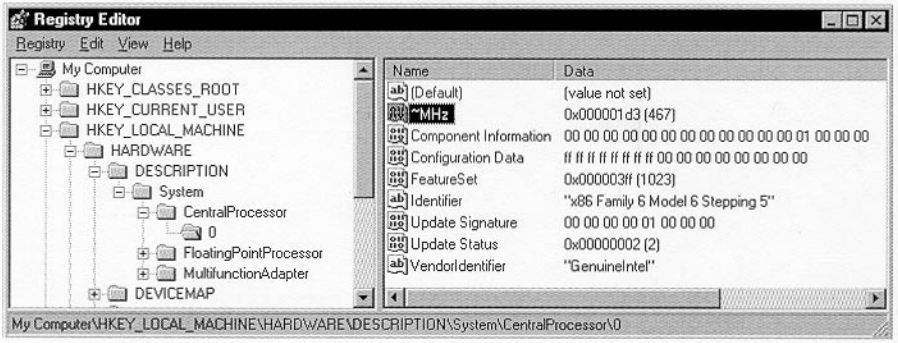

Figure 3. CPU speed information in the Windows/NT registry.

The information about the PC name, network card, Ethernet and TCP/IP configuration are received from system tools started by *InvPC.exe* as external processes. On Windows/NT the system tool is called *ipconfig.exe* and on

Windows/95 the equivalent tool is called *winipcfg.exe.*

The *ipconfig* tool must be run from MS-DOS mode (console mode) and the output sent to a temporary file for later processing. The command that runs ipconfig.exe is:

CMD /C IPCONFIG /ALL > C:\\CERNCTRL.TMP

See figure 4 for typical output from *ipconfig.exe.*

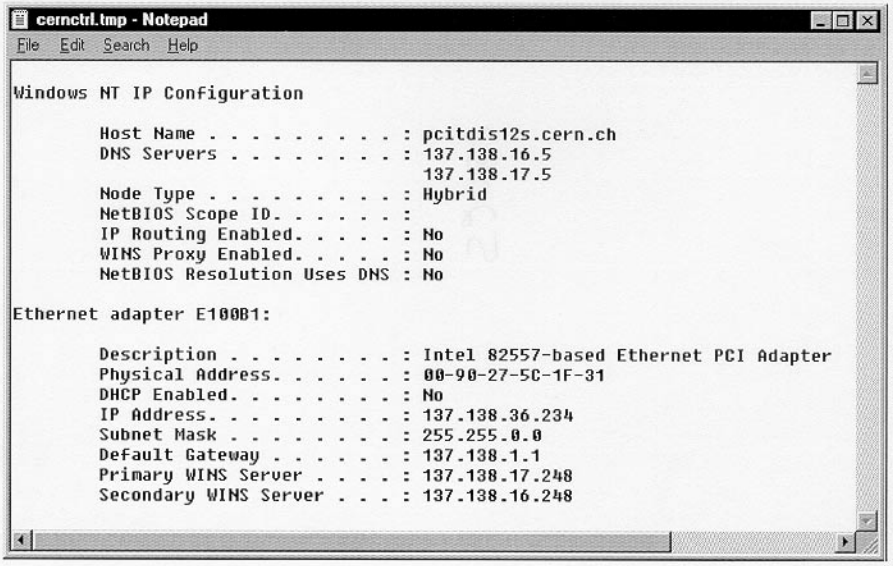

Figure 4. Example of output from *ipconfig.exe*

InvPC.exe includes a module for IP/UDP-support for reporting the inventory data back to a dedicated server using a special format and protocol. One thereby

avoids using the file system directly. This makes processing on the server-side easier.

The inventory program depends upon other components of the distributed NICE architecture. It is run from the shared network disk Z: as a NICE Job policy and is started via the WI script *Z:\A95\Registry\JobsAlways\InvPC.wi2*. See figure 5 for the contents of the script.

The WI script and NICE Job policies are described in the section "System Policies" of "Description of the Desktop installation" in the document "Windows 95/NT administration guide at CERN"[2].

The "Interval" parameter in the WI script sets the time interval in seconds for running the *InvPC.exe* program. The result is that the program will run only once every two weeks.

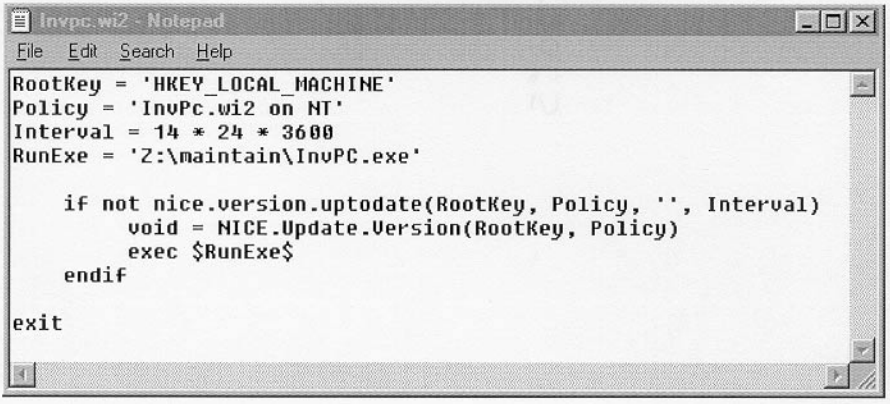

Figure 5. The *InvPC.wi2* script.

[2] http://nicewww.cern.ch/doc/admguide/admguide.htm

Server

The inventory program sends the inventory information back to the dedicated Windows/NT server *NtprintDB*. There the information is stored in a single text file *PCInv.txt* (see figure 6). Each line of the file is a record which contains the information collected about a given PC (see figure 2). It also contains the date and time when the information was collected.

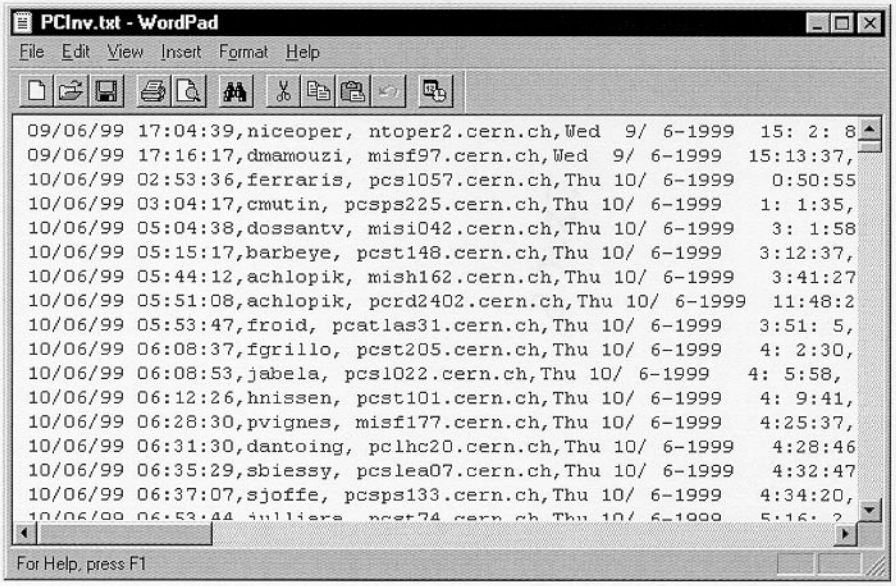

Figure 6. The *PCInv.txt* file.

The file is exported to an Access database (Microsoft Access 97) for convenient analysis by administrators. Microsoft Access gives a user-friendly interface by means of forms, queries and reports.

The database may be stored either on the server or on the local administrator's PC. For the second variant, the database is copied automatically by a scheduled program (see figure 7 for Scheduler configuration). The scheduler runs every morning at 5 o'clock the script *ImportSrc.wi2* shown in figure 8.

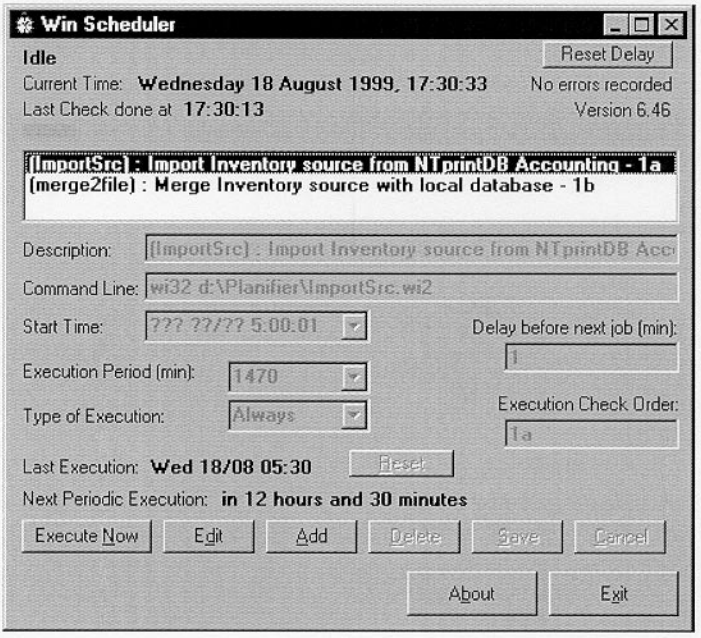

Figure 7. Scheduler configuration

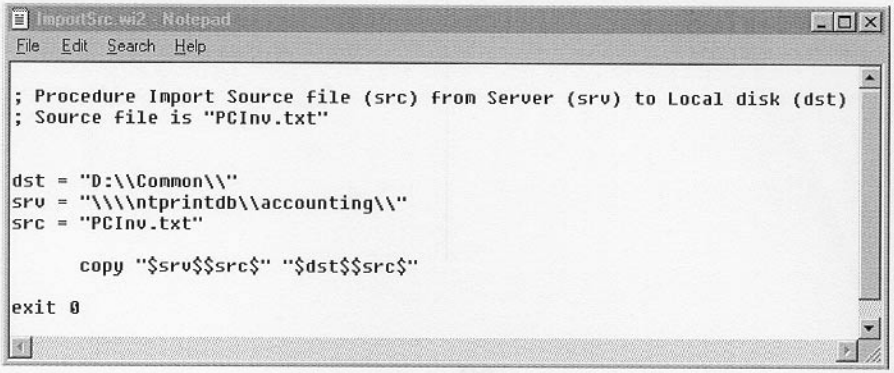

Figure 8. The *ImportSrc.wi2* script.

The Inventory database contains two kinds of tables as shown in figure 9:

- Dynamic tables (updated automatically):
  - *PCInv : The inventory data.*
  - *PCUsers : List of users at CERN.*
  - *Phone : The phone book.*
- Static tables :
  - *Platform : Windows platform (Windows/9x, Windows/NT).*
  - *ServicePack.*
  - *TypeMachine : (Server, Workstation).*

Several statistic queries allow the administrator to select the information by predefined criteria. Examples of criteria are:

- Search machine by platform.
- Search machine by user name.
- Search NT machine by Service Pack.
- Search NT machine by "Product Type" (Server or Workstation).
- Search machine by Divisions.

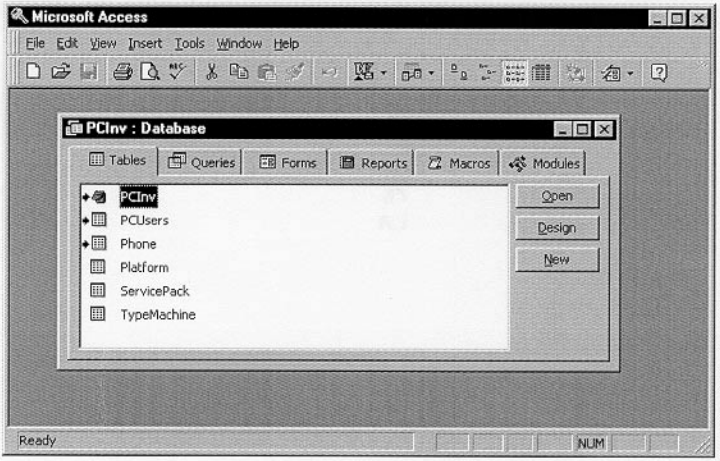

Figure 9. The Inventory database.

The results of the queries are visualized by forms (see figure 10) and reports (see figure 11).

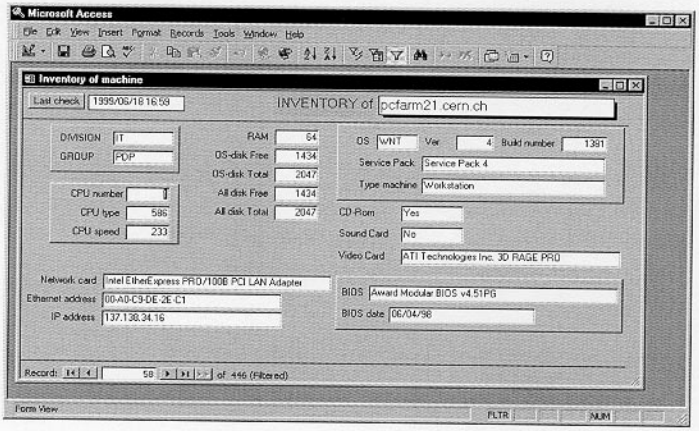

Figure 10. "Search machine by Divisions" form.

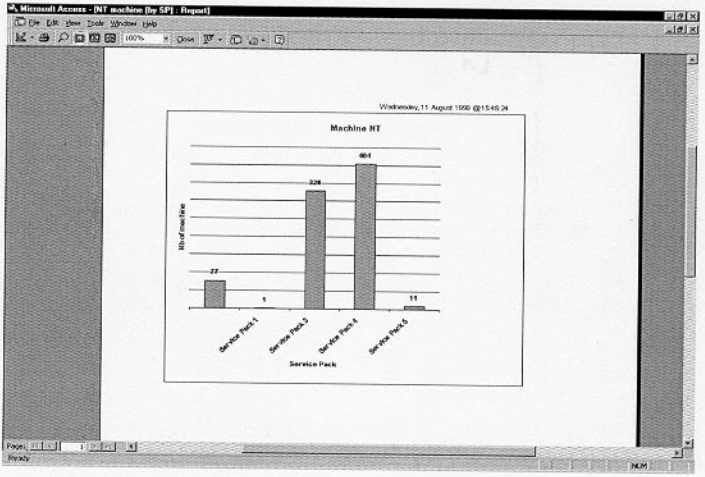

Figure 11. "Search NT machine by Service Pack" report.

Summary

Client side

The client side is improved to obtain more detailed and accurate hardware information than the previous DOS based version. The new application is transparent to the user. The user should not even be aware that the inventory is run on the PC. With the old version, the user would sometimes see a DOS window come and disappear. The old DOS program was less reliable. It could fail to run in exotic PCs or get stuck in BIOS calls. The Windows API hides the hardware from the inventory application.

There are also two negative aspects with the Windows API that are outside our control:

- The Windows API is not rich enough to provide all the inventory information by means of simple function calls. It has been necessary to scan the hardware registry for information as well.
- The hardware registries for Windows/9x and Windows/NT have different paths and layouts, such that two different implementations were required. This difference exists for historical reasons (Windows/NT not being Plug & Play and the use of different development teams inside Microsoft).

Server side

In the old DOS version, each PC generated a unique file containing the inventory information. Collecting the information for all PCs and merging it into a single database was a little elegant solution. The problem was purely historical as the server platform could only act as a file server. The Windows/NT platform provides an environment where it is much easier to implement "value-added services". Together with the user-friendly Access database it provides a turn-key solution where it is easy to add and modify different queries and reports according to demands.

Conclusion

The new inventory tool is a success thanks to team-work in analyzing requirements, writing and testing client code, adding communication software to store data in Access on the NT server and finally the work for providing database queries and reports.

Future

The future of Microsoft is Windows/2000. The Windows/2000 project has been started at CERN shortly after official release in February and we will part our tool to that platform.

Over the years Microsoft has developed and enhanced their tools for system management of clients, SMS. It is tempting to use SMS for distributing Windows/2000 and applications. Therefore the use of the built-in Microsoft developed inventory seems likely in the long term.

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Хаген П. и др.
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Программный комплекс для автоматического сбора, хранения и анализа информации о технической конфигурации компьютеров в локальной сети NICE

Дано обоснование необходимости и сформулированы основные требования к созданию программного комплекса для инвентаризации технической конфигурации ПК. Комплекс включает в себя модуль для сбора и передачи на сервер технической информации с пользовательских ПК и модуль для централизованного хранения ее в базе данных, а также интерфейс генерации запросов и отчетов для администраторов сети.

Работа выполнена в Научном центре прикладных исследований, Лаборатории вычислительной техники и автоматизации ОИЯИ и в Отделе информационных технологий ЦЕРН (Швейцария).

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Program Complex for Automated Collecting, Storing and Analyzing Hardware Information for the Client PCs in the NICE Architecture

The background requirements for the PC hardware inventory project are given. The implementation consists of a program collecting hardware information about client PCs, a server part for storing the data in a central database and a user-interface for administrators to query data and extract reports.

The investigation has been performed at the Scientific Center of Applied Research, Laboratory of Computing Techniques and Automation, JINR and at the Information Technology Division at CERN (the European Laboratory for Particle Physics).

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