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Farm for HEP Prague

The Farm Based on Hewlett Packard Computers for HEP Data Processing
and Development of the Analysis Software for Future HEP experiments
in Prague

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Abstract

The Prague laboratories actively collaborate on experiments carried out at the international laboratory CERN (experiments DELPHI, OMEGA, WA98, ATLAS, ALICE and several R&D projects) and at the national laboratory DESY (experiment H1).

The creation and running of the computer farm based on Hewlett Packard workstations is proposed. The farm should serve for 2 main activities:

- Processing of experimental data created in High Energy Physics Experiments carried out at CERN and DESY.
- The development of the software for future CERN experiment ATLAS based on Object Oriented Methodology using CASE tools.

Contents

1 Introduction

Four Prague research laboratories both from the Academy and Universities collaborate on several experiments in the international centre for elementary particle research CERN in Geneva (DELPHI, OMEGA, WA98 ATLAS, ALICE and R&D projects) and in the German national centre DESY in Hamburg (H1 experiment at HERA collider). The running experiments are producing big amounts of experimental data and both running and proposed future experiments need huge amount of simulated data.

The part of experimental data from experiments DELPHI, OMEGA, WA98 and H1 will be analyzed in Prague. The data analysis normally includes the processing of the experimental raw data and physics analysis of them. The physics analysis requires big samples of simulated data.

The experiment ATLAS is in a design and construction phase, that requires large amount of detector simulation data to enable correct decisions during detector construction. In the same time the development of the simulation and analysis software packages takes place. The complexity and amount of the data which the future experiments will produce is by several orders of magnitude greater than that produced by current experiments. The software for the analysis of these data must be thus very efficient and maintainable during the lifetime of about 10 year. A completely new software based on Object Oriented Methodology needs to be produced for the simulation and analysis of the future ATLAS data. This requires usage of the complex CASE tools during the development and maintenance phase of the experiment. The Prague laboratories also take part in this activity.

The above mentioned tasks require an adequate computer power and modern software and methods and tools to be used. The computer power may be provided by the usage of distributed farm(s) of workstations. The farm must deliver both crunching cpu power for computation itself and must be able to house necessary portion of experimental data and provide access to them. The farm must, as well, support various access methods of the users from X-terminals and PCs and provide user friendly environment for software design and its implementation.

The distributed farm for HEP Prague is being created with financial resources available. More than 60 physicists, PhD students and undergraduates are involved in the HEP research in Prague and the farm is and will be a powerful modern tool for their work which will promote international collaboration with other HEP institutes and last but not least would attract more students into interesting work in HEP done by means of modern tools.

2 Collaborating laboratories

Four laboratories in Prague are involved in the experimental research in high energy physics in collaboration with CERN and DESY:

- Institute of Physics of the Academy of Sciences of the Czech Republic
- Faculty of Mathematics and Physics of the Charles University, Prague
- Nuclear Physics Institute of the Academy of Sciences of the Czech Republic
- Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University

In following some details on each laboratory will be given.

2.1 Institute of Physics of the Academy of Sciences of the Czech Republic (FZU)

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Elementary Particle Physics Division
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Nearly 30 physicists in the Elementary Particle Physics Division are full time involved in collaboration on experiments at CERN (DELPHI, OMEGA, ATLAS, ALICE, R&Ds) and DESY (H1). The main activities are physics simulation, data processing, detector simulation, particle phenomenology study and theoretical computation. The division runs several interconnected unix workstations (5 HP and 4 SUN) 30 GB of disk space, 12 PCs and 2 MACs,

The division provides support for ASIS software from CERN for used hardware platforms. Also, software for collaborating experiments is supported. AFS clients are available.

2.2 Faculty of Mathematics and Physics of the Charles University, Prague (MFF UK)

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of Faculty of Mathematics and Physics
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More than 15 physicists and students in the Nuclear Centre and the Department of Nuclear Physics of the Faculty work on experiments carried out together with CERN (DELPHI, ATLAS, R&Ds) and DESY (H1). They make physics simulation and experimental data processing, detector studies and theoretical calculations. Few more students and PhD students use the equipment for work on their theses. They use two HP715 workstations, X-terminals and PCs for work on CERN experiments and one Silicon Graphics station to support the activities at H1. AFS clients are installed on HP nodes.

2.3 Nuclear Physics Institute of the Academy of Sciences of the Czech Republic (UJF)

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Nuclear Physics Institute
of The Academy of Sciences of the Czech Republic
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Eight physicists and four PhD and diploma students from the Nuclear Physics Institute collaborate with CERN on experiments WA98, ALICE and R&Ds and also with GSI on experiments TAPS and HADES. They use three HP workstations, 11 GB of disk space, one VAX station and several PCs. They are active in data simulation and processing and detector studies.

2.4 Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University, Prague (FJFI)

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Several physicists from the Faculty take part in the experiments carried out together with CERN (ATLAS, R&Ds). They are active in detector instrumentation and detector studies. The computing equipment is used for teaching purposes and as software repository, too. Their group uses HP715 and number of PCS, they run data acquisition with the help of their HP station.

3 Configuration and functionality

Our target is to create a distributed scaleable computer farm with the basis in the Institute of Physics AS CR. The Institute has already infrastructure and experience with data processing. The computer connection between the institutes is on the level of 64 kbps and should be enhanced to 155 Mbps via Prague Academic ATM connection in the beginning of 1996.

The computing capacity is coming to saturation and new ways of development are searched. In the HEP division of the Institute of Physics HP multiprocessor server usage is discussed. The Computing centre of the Institute plans to buy 2 SUN servers. The server in the HEP division of the Institute of Physics would serve mainly for batch processing for the all 4 laboratories. The group in the Faculty of Mathematics and Physics plans to add several workstations and X-terminals. The experimental data will be read from EXABYTE tapes to 20 GB buffer disk space. The intensive processing may be done either on the server nodes or even remotely when ATM connection becomes available to other laboratories. All laboratories can use nqs (nqs++) to submit batch jobs to the Institute of Physics or to their local stations. It is important to solve data access via DLT tapes and also system and user backup via automatic tools. The software is already available, as HEP FARM Prague already bought software site license from HP.

Table 1 summarizes plans for development in the separate laboratories.

The user friendly and user accessible backup system is crucial for such type of work.

4 Summary

Four laboratories in Prague are deeply involved in HEP experiments carried out at CERN and DESY. They have built up a small scale computer environment for their work based on HP workstations.

New ways of collaboration with HP are searched for. With the target of fitting the architecture and the power of the farm to the needs. The list of items for planned upgrades is displayed in Tab. (1). This will help to increase substantially productivity of the work and will open new interesting and attractive fields of the work in high energy physics for students – OO design with the use of CASE tools.

We highly acknowledge the help of the Hewlett Packard already made, that helped to start several services at the farm and surrounding institutes.

Institute of Physics	multiprocessor server with 20 GB disk space software license for the server ATM bridge, Ethernet switch ATM cards to the central farm DLT robot for 10 cassettes User and system backup robot (magneto-optics) X-terminals Scanner Colour Postscript printer DAT unit, CD-ROM UPS Software for OO design
Fac. of Math. and Phys.	Workstation on the level of HP735 Communication enhancement (ATM + switching) ATM cards to the central farm X-terminals robot with 10 magneto-optical disks A3 postscript printer Scanner UPS
Nucl. Phys. Inst.	Workstations Communication enhancement Scanner UPS
Fac. of Nucl. Sci. and Phys. Eng.	32 MB RAM for HP715 Workstation Scanner UPS

Table 1: Planned development of HEP FARM Prague.