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The difficulties encountered during this study happen to be also the critical points that must be solved for a succesfull evolution of our software environments such as preserving the vast amount of cultural investment provided in the existing physics code, or dealing with the increasing influence of industry, where the constraints or requirements may not be the same as ours.The preliminary results that emerge from this first year study show that even more than the concept of object orientation (which nevertheless isthe most mature and coherent approach in the domain of SE methods) the demand for an engineering approach to software production seems to be the principle criterion for a quality improvement process. In particular, we have shown and experienced that the following actions are essential in this process :

o establishing an important training and teaching program in our community.

o sharing the software production process between all members of the team, from the early specification collection down to the final design phases.

o introducing explicit quality criteria that can be tested upon at every stage of the sofware life cycle, through conventions, code reviews or management tools,

o using standards (industrial or not) as much as possible in the underlying technology.

o organizing the software architecture around the notion of a framework of reusable components that are responsible for providing services to each other.

B. Data Access and Storage

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The High Performance Storage System (HPSS)

KENNETH L. KLIEWER (OAK RIDGE)

Ever more powerful computers and rapidly enlarging data sets require unprecedented levels of data storage and access capabilities. To help meet these requirements, the scalable, network-centered, parallel storage system HPSS was designed and is now being developed. The parallel I/O architecture, mechanisms, strategies and capabilities are described. The current development status and the broad applicability are illustrated through a discussion of the sites at which HPSS is now being implemented, representing a spectrum of computing environments. Planned capabilities and time scales will be provided. Some of the remarkable developments in storage media data density looming on the horizon will also be noted.

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Mass Storage System by using Broadcast Technology

HIROFUMI FUJII (KEK)

There are many similarities between data recording systems for high energy physics and braodcast systems; e.g., 1) the data flow is almost one-way, 2) requires real-time recording, 3) requires large-scale automated libraries for 24-hours operation, etc. In addition to these functional similarities, the required data-transfer and data-recording speeds are also close to those for near future experiments. For these reasons, we have collaborated with SONY Braoadcast Company to study the usability of broadcast devices for our data storage system. Our new data storage system consists of high-speed data recorders and tape-robots which are originally based on the digital video-tape recorder and the tape-robot for broadcast systems. We are also studying the possiblity to use these technologies for the online data-recording system for B-physics experiment at KEK.

Data Storage Using Scanning Probes

BRUCE D. TERRIS (IBM)

It is anticipated that magnetic data storage will exceed a density of $1.5x10^9$ bits/sq. cm. ($1x10^{10}$ bits/sq. in.) within the next 10 years, and quite possibly achieve even higher areal densities. However, with the invention of new scanning probe microscopes, it is possible that new technologies will emerge which can achieve higher data densities. These techniques have demonstrated the ability to manipulate matter on the atomic scale, and thus offer the potential of extremely high data densities. In this talk, I will review some of these new scientific techniques, including scanning tunneling, atomic

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force, and near-field optical microscopes, with particular attention on their application for data storage. The challenges in advancing these techniques from scientific tools to real data storage technologies will be highlighted.

C. Data Acquisition and Triggering

The KLOE DAQ System and DAQ Issues for Experiments in the Year 2000

MARY FERRER (FRASCATI)

DAQ Issues and Status of R&D for DAQ for LHC Era Experiments

J. HARVEY (CERN)

D. Worldwide Collaboration

Public Parks for the Global Village

C. MALAMUD (INTERNET MULTICASTING SERVICE)

Computing in the next millenium will be different, but how? In this talk, Carl Malamud argues that we can shape the global village, building parks, schools, museums and other public facilities. He'll discuss global infrastructure projects underway in 1996 including the Internet Railroad and the Internet 1996 World Exposition, a world's fair for the information age.

Tools for Building Virtual Laboratories

STEWART C. LOKEN (LBL)

There is increasing interest in making unique research facilities accessible on the Internet. Computer systems, scientific databases and experimental apparatus can be used by international collaborations of scientists using high-speed networks and advanced software tools to support collaboration. This paper will present examples of tools such as video conferencing and electronic whiteboards that are being used to create examples of virtual laboratories. The paper will also describe two pilot projects that are being used as testbeds for the tools. The first is the Multidimensional Applications and Gigabit Internetwork Consortium (MAGIC) testbed which has been established to develop a very high-speed, wide-area network to deliver real-time data at gigabits-per-second rates. The second is a remote experiment at LBL's Advanced Light Source.

E. Software Tools, Languages and Environments

Experiences with Object Oriented Parallel Plasma PIC Simulation

VIKTOR K. DECYK (UCLA, JPL CALTECH)
Charles D. Norton (Rensselaer), Bolek K. Szymanski (Rensselaer)

One goal of the Numerical Tokamak Project, a High Performance Computing project, is to model a tokamak (fusion) plasma with $10^8 - 10^9$ particles to explain anomalous transport of particles and energy. This ambitious computation requires (1) High parallel efficiency, (2) high performance on RISC processors, and (3) some way to organize an increasingly complex code with multiple (and separated) contributers. This talk with focus mainly on item (3), and will discuss the use of object-oriented programming in organizing a parallel particle- in-cell code. Comparisons will be made between C++ and Fortran 90 as object oriented languages. Their value and usefulness (or lack therefore) will be discussed in the context of this project.
