Use of Distributed System CHARM at U70 Neutron Beam Experiments

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The distributed system **CHARM [1]** for data processing and analysis in particles physics experiments is advanced. An effective solution of a two-uniform task of processing great volumes of the information and support of high-speed computing processes is realized on the basis of an inhomogeneous computer platform. The scheme of the computer platform is shown on the figure:

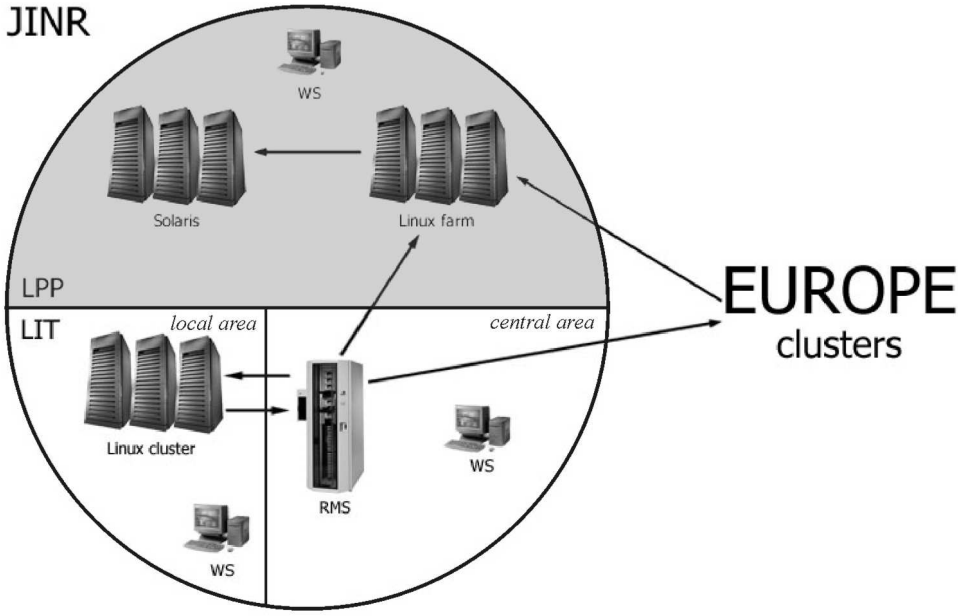

Fig.1: The structure of computer platform CHARM-2003 system

At some decrease in the level of protecting the resources shown in the top part of the figure, and use of elements of infrastructure GRID, developed in LIT JINR, the configuration of the computer platform gets significantly simpler (Fig.2).

The created system provides processing big data sets (TerraByte range) due to integration of the mass centralized memory with local file servers of cooperating laboratories. High efficiency is achieved, in particular, due to automatic algorithms of parallel processing developed and realized on the basis of the theory of heterogeneous multilinear systems of queuing. The control system of parallel processing provides dispatching tasks as well as interrelation between the processes of solving of one task.

In the current year, the efficiency and reliability of the distributed CHARM system functioning in a mode 7*24, has considerably raised. Increase of system performance, allowed one to release users from routine work in a contour of mass processing, is achieved due to using the results of development of the GRID-infrastructure in LIT JINR. One of the main results of this development is virtualization of hardware components (fundamental

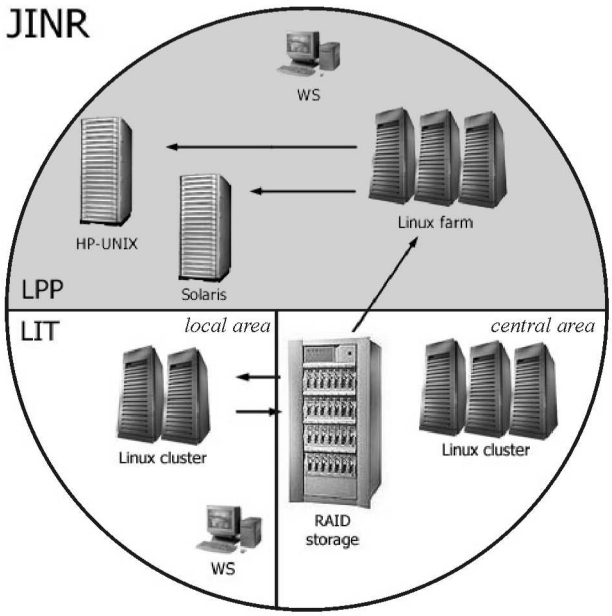

Fig.2: The structure of a computer platform CHARM-2005 system

concept of GRID - system), in particular, mass storage. The nonivasive databases, registered by setups Neutrino Detector and EXCHARM, are created. A significant result of implementing the distributed system in real experiments is its usage as a testbed for accommodating GRID-technologies, revealing critical parts, elimination of ineffective cooperation.

All mathematical processing of modeling information and primary experimental data registered by the EXCHARM spectrometer, is realized by this system. Data processing and analysis in the considered system include:

1. Definition of parameters of model (a transfer function the signal / response of physical apparatus).

Parameters α_i, h_i, z_i we search from a condition of a minimum function:

$$M = \frac{1}{2}\sum_{j=1}^{N}\sum_{i=1}^{m} w_{ij}((a_{xj}z_i + b_{xj})\cos\alpha_i + (a_{yj}z_i + b_{yi})\sin\alpha_i + h_i - x_{ij})^2.$$

Here

N - quantity of the trajectories which have been lost through m detectors;

$a_{xj}, a_{yj}, b_{xj}, b_{yj}$ *– parameters of trajectory j in an uniform system of coordinates XYZ (a full set of parameters of the spatial trajectory approximated by a linear function);*

x_{ij}, w_{ij} *– the measured coordinate and its weight.*

Magnetic calibration, definition of actual function and variations in time of a magnetic field on the basis of results of processing trajectory information, base function of a magnetic field , statistical time series, etc.

2. Trackfinding and definition of trajectories parameters of the accelerated particles. As models of trajectories at a level track recognition splines are applied, and at estimation of parameters - an integral of the motion equations.

3. Generation of results of mathematical processing - data sets of a physical level (DST), as initial information for solution of the specific physical tasks or a collection of close tasks [2-5].

Communication on the management specified before problems and a problem of a compacting adjoining it and to formation Mini-, Mycro-DST has appeared inefficient and has been replaced with information communication. The main reasons are connected with a problem of check points and multipassing process [DST] => [MINI-DST].

The nearest plans - participation in preparation of software for analysis of data, registered with Neutrino Detector; development of algorithms and programs for decision, in particular, the following tasks (http://sunse.jinr.ru/cdsagenda//fullAgenda.php?ida=a0543):

- the quantitative analysis of inclusive production charmed-baryon Λ_c^+ in neutron-carbon interactions;

- estimations of Omega and Omega bar hyperons production in the EXCHARM experiment;

- the quantitative determinations of nuclear effects at a hyperon production in a neutron-nuclear interactions.

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