

# Analysis of Program Packages on the Cluster Networks

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**Abstract-**The paper deals with the Analysis of existing software packages on the cluster systems, comparative characteristics of the existing cluster systems. There are problems of parallel computing, arising from the use of the cluster package MPI / MPICH. Unlike other systems, this package lacks integration with the queue management system, thus, it requires a modification that takes into account the peculiarities of a specially distributed environment.

**Index Terms-** cluster, Computing, scheme

## I. INTRODUCTION

Today, the most relevant way to create powerful multiprocessor systems is to combine mass-produced

computers, such as PCs via serial telecommunication equipment LANs (or more high-performance connections). Hence, for the purpose of this paper, a cluster is defined as a group of interconnected servers and personal computers functioning as a unit[1],[2],[3].

## II. ANALYSIS OF EXISTING SOFTWARE PACKAGES ON CLUSTER SYSTEMS

The result of creating a cluster can be, for example, the high availability of information services and parallelization to perform any complex operations or business computer system failover [1],[4],[5]. Figure 1 shows the general scheme of the cluster.

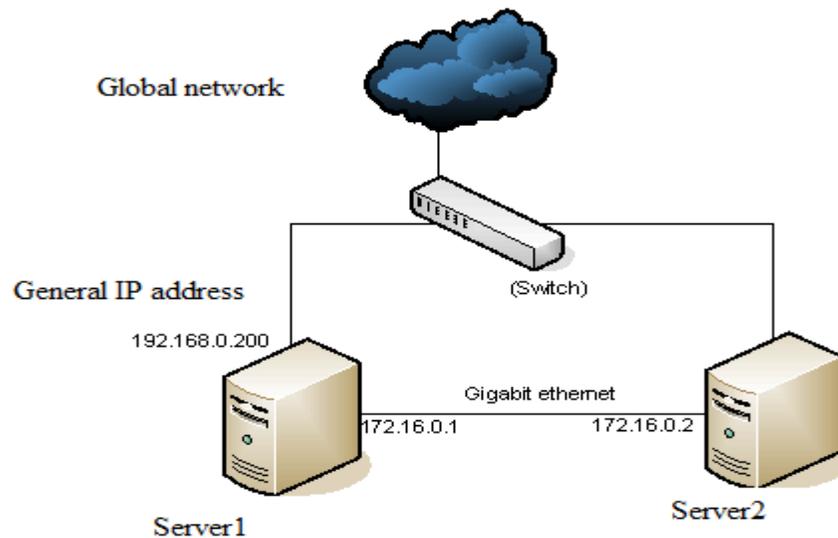


Figure 1. The general scheme of the cluster

**Cluster:** It is poorly integrated architecture, both at the level of equipment and in the operating system (OS). In particular, due to the lack of shared memory for each processing, node that must be running its own copy of the OS. The main critical issue when working with cluster complexes, the number of processors 64-128, is maintenance and management. Solutions, for various companies which developed special software systems, are discussed below. In addition we must distinguish cluster systems classification.

**High-availability clusters:** abbreviated as HA (high availability) have been created to provide high availability of service. Excessive numbers of nodes in the cluster ensure the provision of service in the event of failure of one or more

servers. The typical number of nodes (being two) is the minimum amount that, resulting in increased availability, offers a lot of software solutions for building such clusters. In particular, for OpenVMS, GNU / Linux, FreeBSD and solaris, there is a project of free software, Linux-HA.

**Clusters load:** Their operating principle is based on the distribution of requests through one or more input nodes which redirect them to other computing nodes for processing. The main characteristic of the cluster is productivity which, however, is frequently used as methods to enhance reliability. Such structures are called server farms. Software (SW) can be either commercial (OpenVMS, MOSIX, Cluster, Platform LSF HPC,

Sun Grid Engine, Moab Cluster Suite, Maui Cluster Scheduler), or free (Linux Virtual Server) .

**Computing clusters:** These clusters are used for computing purposes, particularly in research. Computing clusters meaningful indicators are high performance processor operations on floating-point numbers (flops) and low latency unifying network and less important - speed IO; the latter is more important for databases and web-services. Computing clusters can reduce the computation time, compared to a single computer, smashing job running parallel branches that communicate via network connection. One of the typical configurations is a collection of computers collected from publicly available components installed on them, the Linux operating system and related network Ethernet, Myrinet, InfiniBand, or other relatively inexpensive networks. Such a system is usually called (cluster Beowulf). Specifically, there is the HPC clusters (referred to by the English. Acronym HPC (Cluster - High-performance computing cluster) .

#### **Analysis of software and tools to install on a cluster**

There is a set of software that simplifies the process of creating and maintaining the cluster systems. These software systems are categorized as follows [4] :

Funds to install the software (software) on a cluster; the regular administration of clusters; Cluster batch control system (OSS); and Integrated software for clusters. Interest is integrated software for clusters; but in order not to leave the other categories of systems aside, we give a brief description of such categories.. Tools solve the following tasks: Creating Depository (set of software for the cluster); updating its versions ; distribution software on the cluster nodes; automatic installation of software on the cluster nodes and their configuration.

- **System Imager:** It is a free tool to automate the installation of Linux on a cluster machine and works with the software installed on the file level, rather than bit by bit. It can distribute itself between the machines and software data files while configuration changes and updates the OS.

- **LCFG:** This is an open source system to automate the installation and configuration of different versions of Unix. LCFG works quickly and is suitable for clusters with diverse and frequently changes configurations of nodes.

#### **Cluster Batch Control System**

Cluster batch control system (PPS)— or as it is are called, the resource manager, Cluster Systems Management— is a software used in multiprocessor systems that operate in batch processing tasks. The most popular freeware types are PBS, SGE and Condor as well as commercial LoadLeveler, LSF and Maui. Using open source software, the user works with a single multiprocessor computer complex packet processing tasks. Tasks are placed in common to all complex, single interface to run, modify, remove and get information about the jobs. ACT automatically distributes tasks across the nodes based on their load, performs and delivers the results to the user.

**PBS :** Portable Batch System provides job management in batch mode in a computing environment that runs Unix. Today a OpenPBS - free version and PBSPro is offered and there is an extended commercial version.

**Torque (Terascale Open-source Resource and QUEUE Manager):** It is a new version of PBS, developed by Cluster

Resources and is based on OpenPBS. The system has a number of additional improvements as follows :

- Improved scalability (work in environments up to 2500 nodes).
- Increased fault tolerance (introduced additional checks).
- Improved interface scheduler with a view to provide additional and more accurate information.
- Improved system of records in the log files.

**Sun Grid Engine:** It is a free version for managing the resources of one project or division. Based on the full service of centralization of resources and users, Sun Grid Engine is implemented by an open community of developers and is sponsored by Sun Microsystems.

**Sun Grid Engine, Enterprise Edition (SGEEE):** It is a commercial version, designed for enterprise resource management and able to serve several independent projects and user groups. PBS and SGE system are approximately equal in their capabilities and assume full allotment under batch processing machines. They support network clusters, uniprocessor machines, and multiprocessors SMP and MPP .

- **Condor: it is** open-source product; the main characteristic of this product is that the performance of tasks distributed among computers in the moments when they have spare CPU time. Therefore Condor has several important mechanisms to support checkpoint and restart the migration job. Powerful language resource description can reliably describe the requirements for the types and amounts of resources from the task .

- **LoadLeveler:** it is a commercial software product for companies such as IBM, designed for batch processing of serial and parallel (multiprocessor) jobs on clusters of computing servers. The system provides a means to prepare launching and tracking tasks in batch mode in a heterogeneous network of computers .

- **LSF (Load Sharing Facility):** it is commercial cluster system of Platform Computing Corporation for batch control. It meets the basic requirements for the ACT: support queue, collects information on the availability and employment of resources in the cluster, finds computers with suitable resources for assignments, and supports modes of control points (checkpointing), migration and other tasks .

- **MAUI: It is** an outdoor product that features a large set of scheduling modes and the presence of pre-booking mechanism. This free software is capable of providing automatic start of multiprocessor tasks and minimizing simple resources. Implementation is based on a powerful scheduling algorithm Backfill.

### III. PARALLEL COMPUTING PROBLEMS THAT ARISE FROM USING A CLUSTER PACKAGE MPI MPICH.

MPICH implementation allocates the specified number of processes between the available computing nodes without restrictions on their available resources. Furthermore, MPICH ignores information structure assignment and task constituent heterogeneity, which leads to a potential performance loss. Therefore, in computer clusters along with MPICH, it is

recommended to software such as job schedulers and resource managers. But here we have to take into account the fact that these applications are usually used for a wide range of tasks, and they can not take into account the specific features of various problems arising when solving the composite job. These facts lead to the realization of the need for relating the capabilities of the scheduler with the internal structure of solved tasks, as well as problems with queues such as: no control procedure for starting jobs and resource allocation processes, displaying information about the status of jobs in the queue.

#### IV. CONCLUSIONS

Comparative characteristics of the existing cluster systems. There are problems of parallel computing, arising from the use of cluster package MPI / MPICH. Unlike other systems, it lacks integration with the queue management system, so it requires a modification that takes into account the peculiarities of spatially distributed environment.

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