

Bufny

Architecture

- head node
 - used for logistical computations → manage the cluster, deploy os image to compute nodes, add or remove compute nodes or users, job management, queue management, DHCP
 - has a monitor, keyboard and mouse used for administrative purposes
- compute nodes
 - more powerful (CPU/RAM) → dedicated to heavy computational tasks (tasked from head node)
 - identical between them regarding the architecture → smooth run of the tasks
 - either a pc or proprietary enclosure (made to be easily replaceable → everything is modular)
 - no monitor, keyboard or mouse just some usb connectors and ports for debugging

UBB cluster

Compute nodes have slightly different components for processing (CPU/GPU). The new nodes, even though from different manufacturers, are hardware compatible with the old ones.

To have the best performance, the cluster is never virtualized (os runs on physical hardware) → virtualization adds overhead (GPU/CPU/RAM/ I/O) → virtual machine manager sits between os and hardware.

Scheduler: decide where, when and by whom to run a task (equal usage of resources for each user) → always run tasks on compute nodes from head node.

Network:

- intercommunication between nodes → Ethernet network (should provide fast communication between nodes → bottleneck of a process)
- more distance between nodes → fiber optic network

UBB cluster

Compute nodes from different buildings are connected through fiber optic cables. Supports both networks.

- support network → Ethernet network
 - used for administrative purposes from remote areas through console based interface
 - hardware monitoring
 - power control
 - managing nodes
 - dedicated or shared port
 - only condition is the cluster to be connected to a power source → runs independently from the cluster OS

Router: connects the cluster to the Internet → DHCP (gives IP addresses), firewall (only certain IP addresses can access the cluster) and VPN server (secure remote connections). If the head node is the router → two interfaces (one connected to the Internet and one to the cluster)

UBB cluster

Accessed via VPN or a fixed IP.

Storage: Network attached storage connected through fiber optic. Contains spares (hard disks) easily removable/changeable from the system.

Architecture	Hardware	Software
	Compute nodes	Operating system

	Head node	Job Scheduler
	Storage	Libraries - MPI
	Network Infrastructure	Network File System (parallel storage systems)
		DHCP
		DNS

Rocks

Regular user vs. Superuser Installation

- installing with regular user isolates the environment to the folder of that specific user and there's no risk of sabotaging the cluster by running the programs
- installing with superuser offers the capability to install things for all users; useful when dealing with the core of the system

Installation Scope: Cluster-Wide vs. Single System vs. Single Node

Scope	Description	Best Use Case
Cluster-Wide	Software is shared across all nodes.	Ensuring consistency and easy updates across the cluster.
Single System	One system, which may include multiple nodes acting as a unit.	Large-scale computations with shared memory.
Single Node	Installed on a specific node only.	Testing, specialized workloads, or unique configurations.

Synchronization

- important to maintain consistency across the cluster
- the head is the copy for all compute nodes (eg the file hierarchy)

Best practices

- install the core software on the head node and then export it to the compute nodes

- synchronize the configurations to all nodes to ensure consistency
- use regular users for installing things