

Chapter 1

Overview

1.1 Architecture

The architecture of the emulation cluster is given in Fig. 1.1.

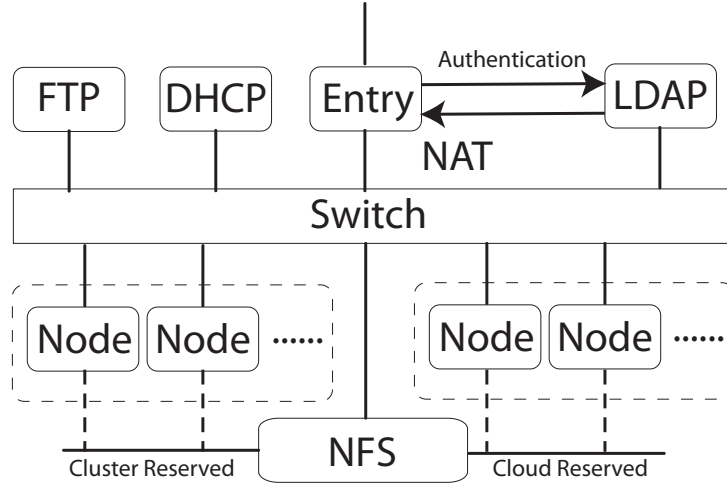


Figure 1.1: Architecture of the emulation cluster.

Entry node: the gateway to the cluster, which ideally should contain two NICs — eth0 and eth1. eth0 is configured with a public IP address (**202.45.128.129**), which is the only entry point to the cluster. eth1 is connected to the switch with a private IP address (192.168.1.1). Currently, the entry node we are using has only one NIC, *i.e.*, eth0, and another NIC is virtualized as a workaround. For future upgrade, the entry node is preferably replaced with a more powerful machine, since it may constitute the performance bottleneck when large-scale jobs are executed on the cluster. For the same reason, the entry node should only handle necessary external requests and access control functionalities, *e.g.*, firewall. A firewall with default rules has been set up on the entry node, which will be further customized when need arises. **Note: NEVER run any of your simulation/emulation programs on the entry node.**

Working nodes: all configured with private IP addresses (ranging from 192.168.1.3 to 192.168.1.252). The working nodes are divided into two groups:

- **Cluster-reserved machines:** about 24 machines are allocated for regular emulation usage, with IP addresses ranging from 192.168.1.200 to 192.168.1.223. They are installed with clean Fedora 8.
- **Cloud-reserved machines:** about 40 machines are allocated to construct a cloud system, with IP addresses ranging from 192.168.1.3 to 192.168.1.41. (**Update**) Now there are another 24 more powerful PCs, with IP addresses ranging from 192.168.1.129 to 192.168.1.153, added to the cloud system. These machines are installed with Xen-bundled Fedora 8.

Refer to Chapter 4 for hardware details of the nodes.

NFS server: A Dell PowerEdge T410 server at 192.168.1.253, where all users' data are stored. When a user logs in to the cluster, NFS directories belonging to the specific authenticated user will be mounted to the machines allocated to the user automatically (a process transparent to the users). The NFS server is configured with RAID-5 for performance optimization and failure tolerance.

1.2 Key Services Installed

The important services installed in the emulation cluster include:

1. **FTP** is used to copy disk image for each working node in cases of failure recovery and fast deployment. There are two images: one is for cluster-reserved nodes and the other is for cloud-reserved ones. Compared with other disk ghost method, *e.g.*, “dd”, we think this is the most efficient way after our careful assessment. Using FTP, finer-grained backup can also be achieved for individual working node, and this can be implemented in future if needed.
2. **DHCP** is used to manage and assign IP addresses to machines when they boot up. We set up the simple static mac-IP mapping policy to ease the management and monitoring tasks in a centralized fashion. An alternative policy is to set up an IP pool and dynamically assign each newly-booted machine with an IP within the pre-set range.
3. **LDAP** is in charge of user account management and user authentication. When a user logs in to the gateway (entry node), he will automatically log in to all the machines allocated to him, *e.g.*, he can “ssh” to any allocated machine freely.

Currently, all the services are installed on the Dell NFS server (192.168.1.253), except that FTP server for copying the cluster-reserved node image is on Machine 192.168.1.2.