

## 1. Functional Requirement

A cloud orchestration is required which could provide IaaS to the user. The main objective to develop this product is to use institutes resources efficiently for research purposes, simulation purposes etc. Requirement of cost cutting on the purchase of hardware because most of the resources goes unused. To make most out of the resources, they are integrated into one cloud (baadal) to provide VMs to users. Following are the requirements as perceived by different users:

### Student as a user:

- Basic operation on VM
  - Start
  - suspend
  - delete
  - pause
  - resume
  - shutdown
  - Take,delete and configure snapshot of the VM
  - Clone VM
  - Attach extra HDD to the VM
  - Get VNC
  - Get VM history and performance
- Operation as a User
  - Register as a user
  - List all the VMs
  - Mailing service to Admin

### Faculty as a User

- **All the functionality of User(Student)**
- See pending request (of VMs) from the students under him/her
- Approve, delete, edit the requests.
- Verify VM owner

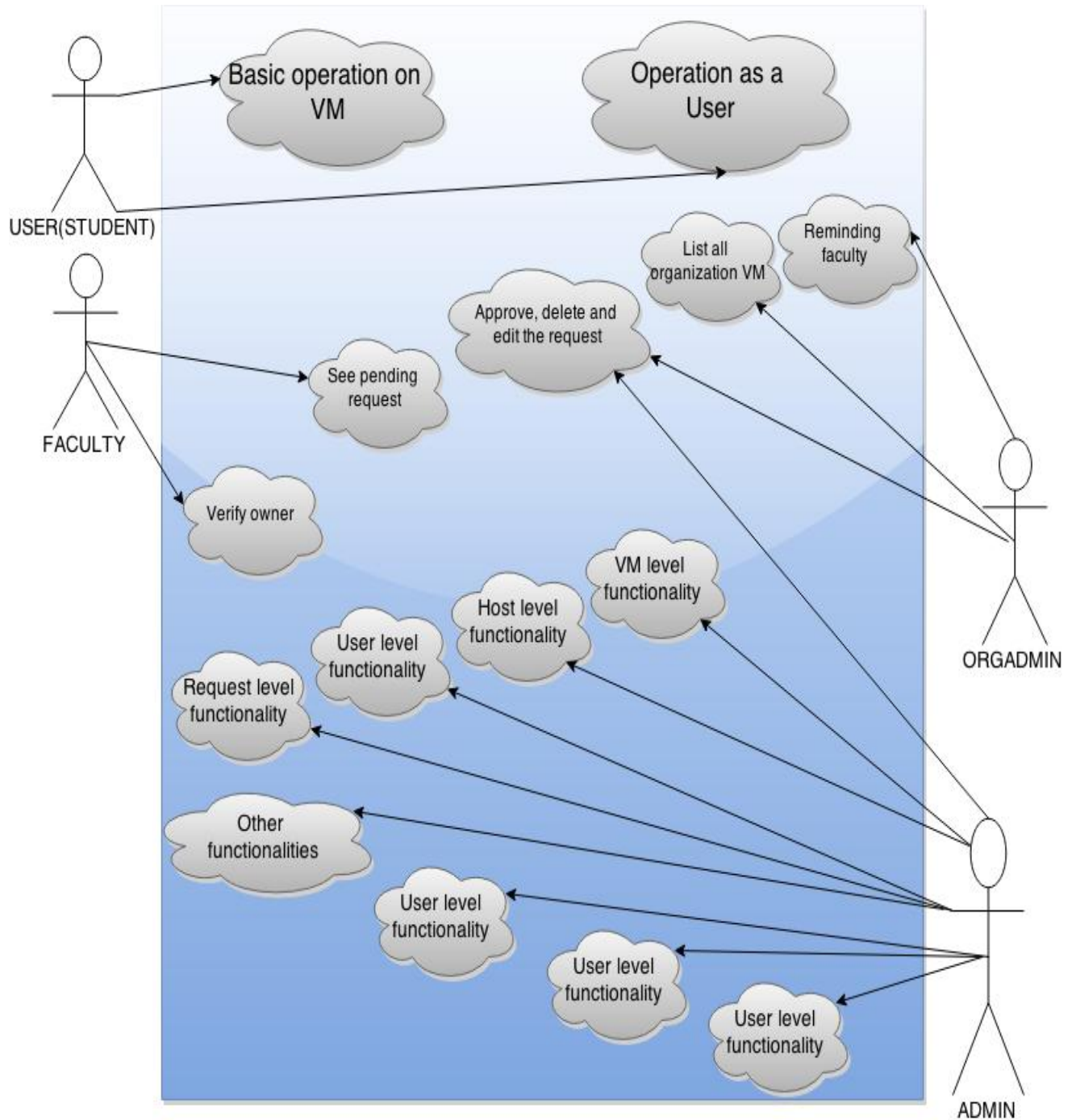
### OrgAdmin as a User

- **All the functionality of User(Student)**
- List all organization level VM
- Approve, Delete, Edit the requests.
- Reminding the faculty for the task to be done by that faculty

### Admin as a User

- VM level functionality
  - List all VMs
  - Manage VM templates
  - Migrate, lock VM

- Sync and deletion of VM
  - Get VM resource utilization
  - Verification of VM resource
  - Launch VM Image
- Host level functionality
  - Get Host details and utilization data
  - Add host
  - Put host on maintenance
  - Boot, shutdown, delete host
  - Show host performance
  - Get updated host graph
  - Host configuration
- Request level functionalities
  - List all pending requests (of any type of owner)
  - Approve, delete the requests.
- User level functionalities
  - Modify user role and type of roles
  - Approve and mail user (of any type)
  - Get user details
  - Add, remove user to VM
  - Remind OrgAdmin about request under him/her
  - Add user with role define for him/her
  - Verify and Remove user
  - Verify extra disk requested by the user
- Other functionalities
  - Manage security domains
  - Manage datastore
  - Get task list from the TASK Queue
  - Ignore, retry any task
  - Perform Sanity check
  - Snapshot and sync sanity check
  - Manage and validate public and private ip pool and range
- Get baadal status
- Shutdown and bootup baadal
- Send shut down baadal mail to all the users

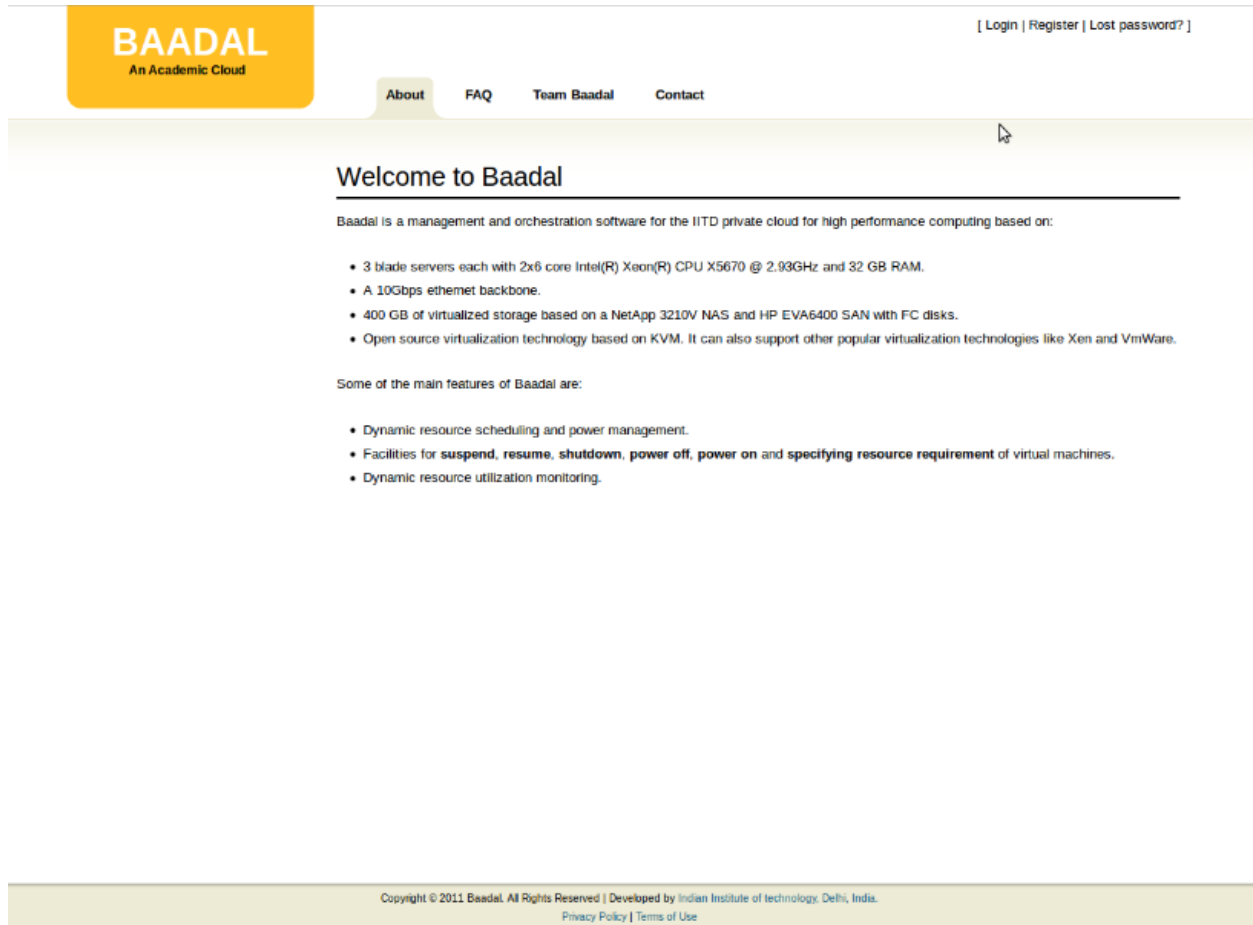


## ADMIN FR

### 1. Baadal HOME PAGE

To open the utility user has to choose any browser (firefox, chrome etc). Then in the address bar, [https://<IP\\_OF\\_CONTROLLER>](https://<IP_OF_CONTROLLER>) and then press enter.

The browser should open the following page:



Click on the login at the right upper corner. Following login page should get open in the browser.

### Login

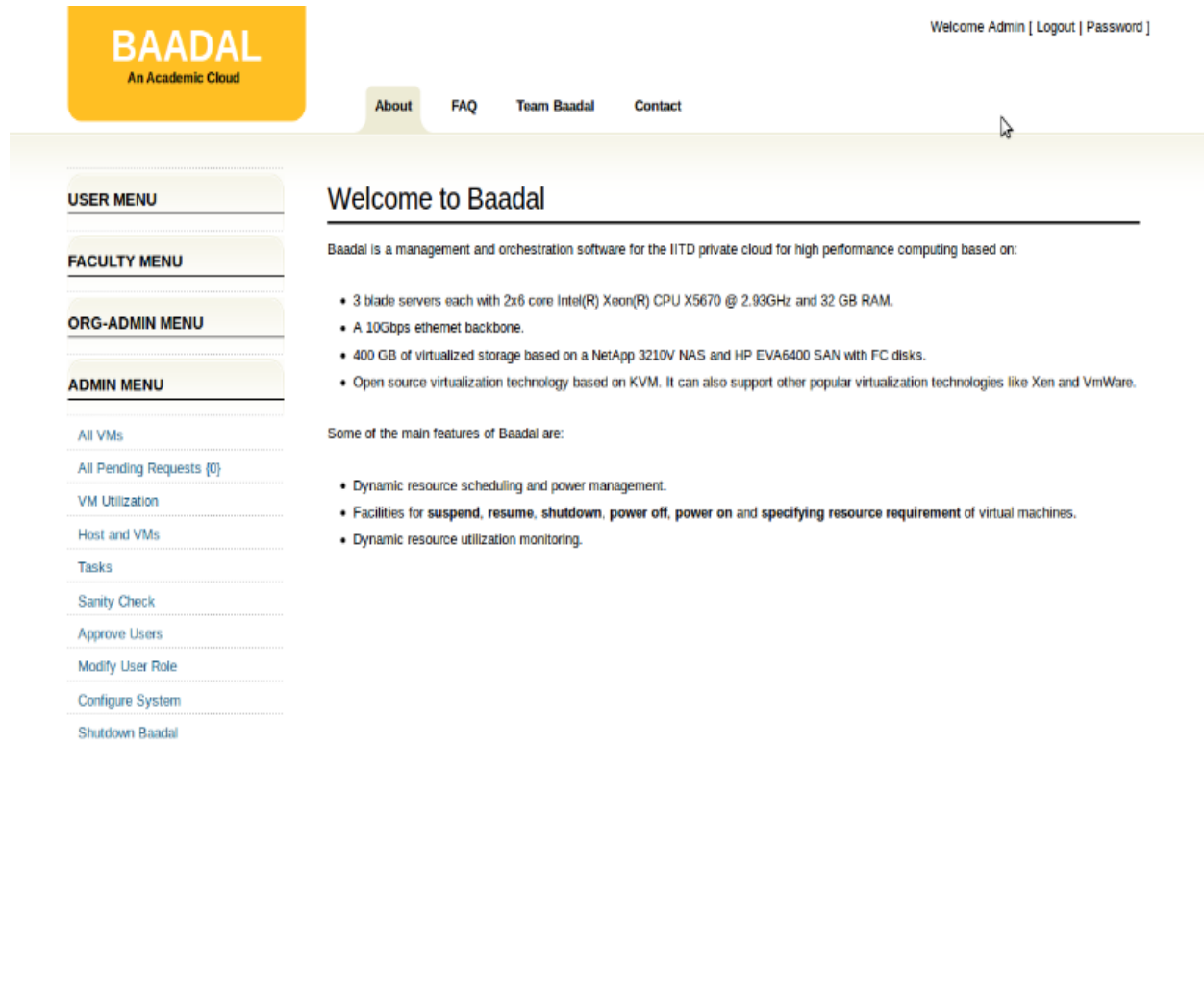
Username:	<input type="text"/>	
Password:	<input type="password"/>	
	<input type="button" value="Login"/>	

[register](#)  
[lost password](#)

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## 2. Title: Admin Interface

On logging into the admin account admin should get the functionality of all the users ["Student", "Faculty", "Org-Admin", "ADMIN"]. Following should be the output.



The screenshot displays the Baadal Admin Interface. At the top left, the Baadal logo is shown with the tagline "An Academic Cloud". To the right, a user greeting "Welcome Admin [ Logout | Password ]" is visible. Below the logo, a navigation bar contains links for "About", "FAQ", "Team Baadal", and "Contact". On the left side, there is a sidebar menu with sections: "USER MENU", "FACULTY MENU", "ORG-ADMIN MENU", and "ADMIN MENU". The "ADMIN MENU" section is expanded, showing a list of administrative tasks: "All VMs", "All Pending Requests [0]", "VM Utilization", "Host and VMs", "Tasks", "Sanity Check", "Approve Users", "Modify User Role", "Configure System", and "Shutdown Baadal". The main content area is titled "Welcome to Baadal" and contains a description of the software as a management and orchestration tool for the IITD private cloud. It lists hardware specifications: 3 blade servers with 2x6 core Intel(R) Xeon(R) CPU X5670 @ 2.93GHz and 32 GB RAM, a 10Gbps ethernet backbone, 400 GB of virtualized storage based on a NetApp 3210V NAS and HP EVA6400 SAN with FC disks, and open source virtualization technology based on KVM. It also mentions support for other virtualization technologies like Xen and VmWare. Below this, it lists the main features of Baadal: dynamic resource scheduling and power management, facilities for suspend, resume, shutdown, power off, power on, and specifying resource requirement of virtual machines, and dynamic resource utilization monitoring.

**BAADAL**  
An Academic Cloud

Welcome Admin [ Logout | Password ]

About FAQ Team Baadal Contact

**USER MENU**

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

All VMs

All Pending Requests [0]

VM Utilization

Host and VMs

Tasks

Sanity Check

Approve Users

Modify User Role

Configure System

Shutdown Baadal

### Welcome to Baadal

Baadal is a management and orchestration software for the IITD private cloud for high performance computing based on:

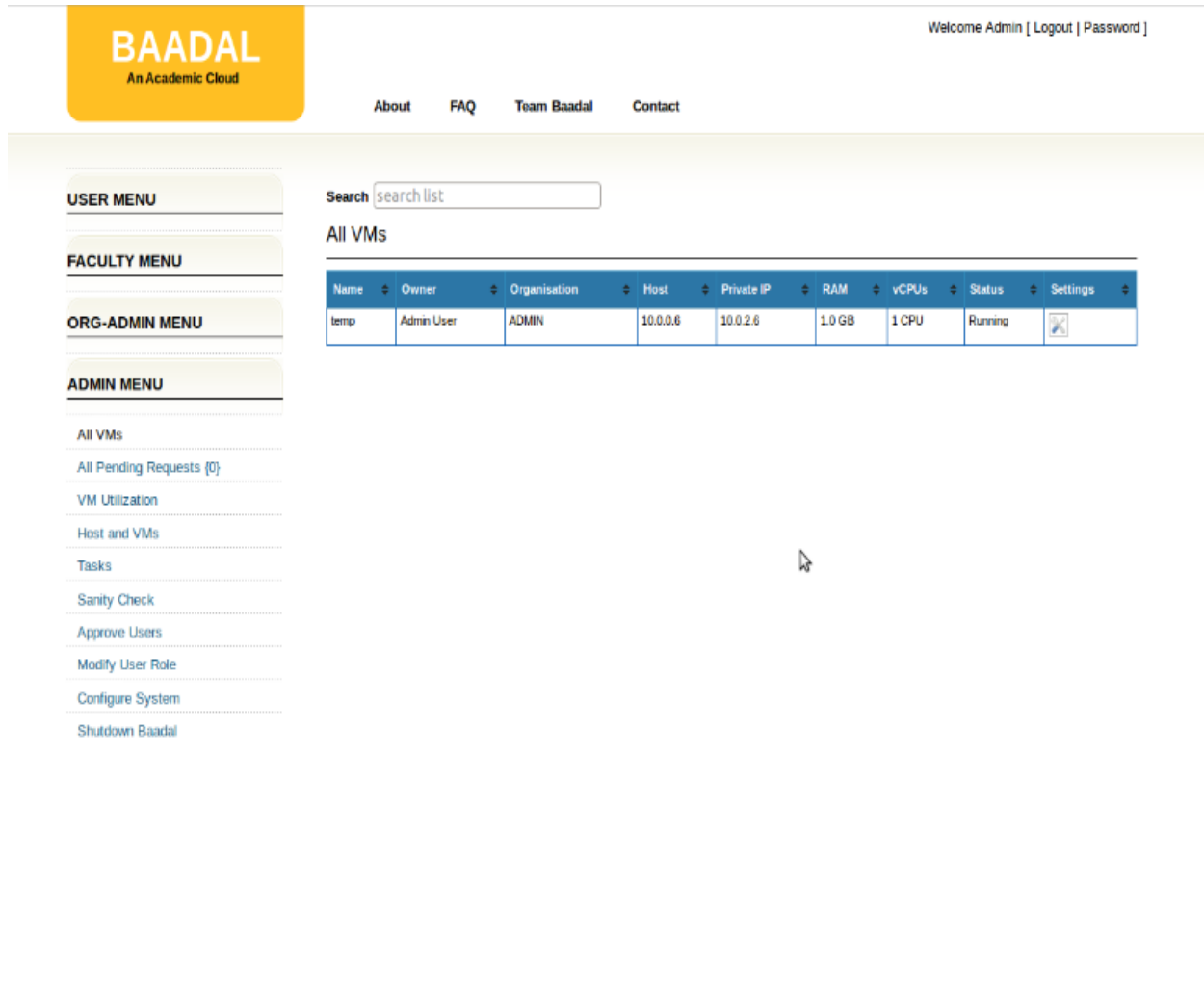
- 3 blade servers each with 2x6 core Intel(R) Xeon(R) CPU X5670 @ 2.93GHz and 32 GB RAM.
- A 10Gbps ethernet backbone.
- 400 GB of virtualized storage based on a NetApp 3210V NAS and HP EVA6400 SAN with FC disks.
- Open source virtualization technology based on KVM. It can also support other popular virtualization technologies like Xen and VmWare.

Some of the main features of Baadal are:


- Dynamic resource scheduling and power management.
- Facilities for **suspend, resume, shutdown, power off, power on** and **specifying resource requirement** of virtual machines.
- Dynamic resource utilization monitoring.

### 3. Title : All VMs list

On clicking **ALL VM** functionality, it redirects to the page where admin can see all the VMs. Following should be the output.



The screenshot displays the BAADAL Admin Dashboard. The header features the BAADAL logo (An Academic Cloud) and a welcome message for Admin with links for Logout and Password. The navigation bar includes links for About, FAQ, Team Baadal, and Contact. The sidebar menu is organized into four sections: USER MENU, FACULTY MENU, ORG-ADMIN MENU, and ADMIN MENU. The ADMIN MENU is expanded, showing options like All VMs, All Pending Requests (0), VM Utilization, Host and VMs, Tasks, Sanity Check, Approve Users, Modify User Role, Configure System, and Shutdown Baadal. The main content area has a search bar labeled 'search list' and a heading 'All VMs'. Below this is a table with the following data:

Name	Owner	Organisation	Host	Private IP	RAM	vCPUs	Status	Settings
temp	Admin User	ADMIN	10.0.0.6	10.0.2.6	1.0 GB	1 CPU	Running	

Name : This is the name given to the VM

Owner : This is the owner name to whom VM is allocated

Organisation : This stands for the organisation to which user belongs

Host : IP address of the host machine in which VM resides

Private IP : This is the private IP to allocated to the VM

RAM : Memory allocated to the VM

vCPU : Virtual CPUs count allocated to the VM

Status : It shows whether the VM is running, Paused, Shutdown etc

Setting : This redirects the page to setting page. It will be explained in <FR>.

#### 4. Title : VM Utilization

This shows the resource utilization of all the VMs of BAADAL. Following should be the output.

The screenshot displays the BAADAL web interface. At the top, the BAADAL logo is on the left, and the user 'Admin' is logged in on the right. A navigation bar contains links for 'About', 'FAQ', 'Team Baadal', and 'Contact'. A sidebar on the left lists various menu items under categories like 'USER MENU', 'FACULTY MENU', 'ORG-ADMIN MENU', and 'ADMIN MENU'. The main content area shows 'VM Utilization Data for Last 24 hours' with a 'Show: Last 24 hours' filter. A table lists the utilization for a VM named 'temp'.

VM Name	Memory	CPU	Network Read	Network Write	Disk Read	Disk Write
temp	1.27%	95.73%	10603880.24	15352151.93	3892.91	957.43

**VM name** : stands for name of the VM

**Memory** : Percentage usage of memory by the VM

**CPU** : Percentage usage of CPU by the VM

**Network Read** : Shows the bytes read through the network

**Network Write** : Shows the bytes write through the network

**Disk Read** : Shows the bytes read from the disk

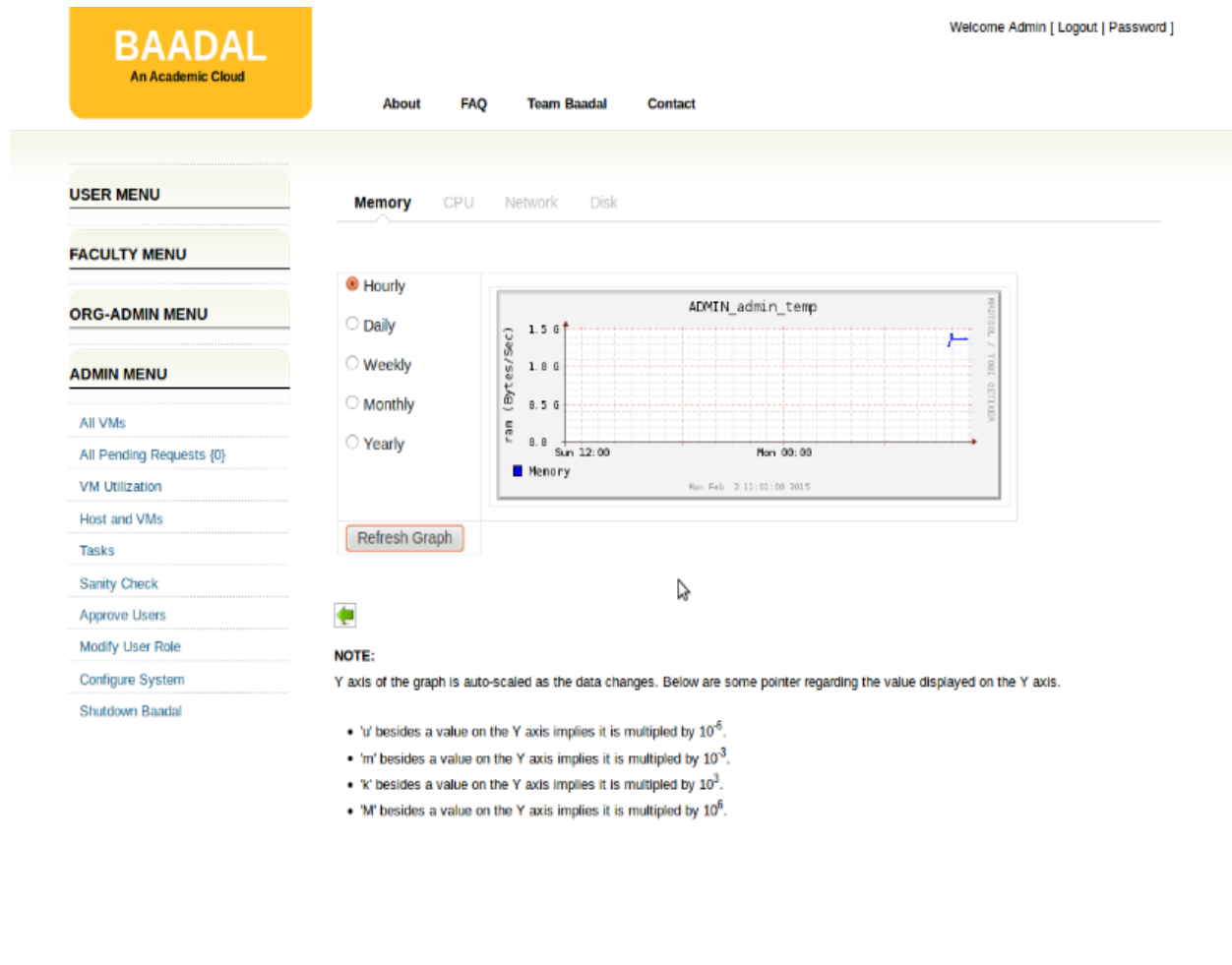
**Disk Write** : Shows the bytes write to the disk



## 5. Title : VM Performance Graph

VM utilization functionality shows the resource utilization of the VM. On clicking the VM name in that utilization table it gets redirected to VM performance page. Where it shows the resource utilization in the form of graph.

It has 4 tabs, Memory, CPU, Network, Disk. Each tab shows the performance graph of that resource utilized by VM. This graph can be perceived on Hourly, Daily, Weekly, Monthly, Yearly basis. Following should be the output of VM performance page.



**Note :** Above page is the output for Memory utilization. Same should be the output for other tabs also

## 6. Title : Tasks (Inside Configure System)

Tasks shows the task assigned to Admin. It has 3 taskbars. They are as follows:

### **Pending Tasks :**

It shows the tasks on go, approved by ADMIN. Output of pending tasks should be as follows. This shows Task ["Create VM", "Delete VM", "Snapshot VM", "Suspend VM", "Shutdown VM", "Pause VM", "Start VM"].

VM (Name), Requested By (User Name), Requested Time shows the time at which the task was requested by the user, and final time shows the time at which task is completed.

The screenshot displays the BAADAL web application interface. At the top, there is a yellow header with the BAADAL logo and navigation links. The main content area is divided into a sidebar menu and a main task list. The sidebar menu includes sections for User, Faculty, Org-Admin, and Admin. The main task list shows a table of pending tasks.

**BAADAL**  
An Academic Cloud

Welcome Admin [ Logout | Password ]

About FAQ Team Baadal Contact

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

- All VMs
- All Pending Requests (0)
- VM Utilization
- Host and VMs
- Tasks
- Sanity Check
- Approve Users
- Modify User Role
- Configure System
- Configure Host
- Host Networking Graph
- Configure Templates

Showing: 20

**Pending Tasks** Completed Tasks Failed Tasks

Task	VM	Requested By	Request Time	Final Time
Create VM	rawing	Admin User	2015-02-02 11:09:35	None

### **Complete Tasks :**

It shows the tasks which were approved by ADMIN and they got completed.

BAADAL

An Academic Cloud

Welcome Admin [ Logout | Password ]

About

FAQ

Team Baadal

Contact

USER MENU

Home

Request VM

Pending Requests

My VMs

My Tasks

Mail Admin

FACULTY MENU

ORG-ADMIN MENU

ADMIN MENU

All VMs

All Pending Requests (0)

VM Utilization

Host and VMs

Tasks

Sanity Check

Approve Users

Modify User Role

Configure System

Configure Host

Host Networking Graph

Configure Template

Show: 20

Pending Tasks

Completed Tasks

Failed Tasks

Task	VM	Requested By	Request Time	Final Time
Create VM	temp	Admin User	2015-02-02 09:35:53	2015-02-02 09:40:40
Delete VM	dsiso	Admin User	2015-02-02 08:58:10	2015-02-02 08:58:15
Create VM	dsiso	Admin User	2015-02-02 08:51:04	2015-02-02 08:51:31
Delete VM	ubu	Admin User	2015-02-02 08:40:27	2015-02-02 08:40:43
Create VM	ubu	Admin User	2015-02-02 08:36:23	2015-02-02 08:37:51

## Failed Task :

In case a task got failed then it would be shown in failed task tab as below:

BAADAL

An Academic Cloud

Welcome Admin [ Logout | Password ]

About

FAQ

Team Baadal

Contact

USER MENU

FACULTY MENU

ORG-ADMIN MENU

Pending Org-Level VM Approvals {0}

ADMIN MENU

All VMs

All Pending Requests {0}

VM Utilization

Host and VMs

Tasks

Sanity Check

Approve Users

Modify User Role

Configure System

Shutdown Baadal

Showing 1 of 1 items

Pending Tasks

Completed Tasks

Failed Tasks

Task	VM	Requested By	Debug Info	Request Time	Final Time	Action
Create VM	ds83	neeraj rawat	Error	2015-02-11 08:29:11	2015-02-11 08:29:36	TRY AGAIN   IGNORE

**Task :** Type of task. In this case it is “Create VM”

**VM :** This is the name of the VM

**Requested By :** Name of the user who requested for the VM

**Debug Info :** “Error” is a hyperlink. It redirects to the page which contains the Error Debug Trace.

**Request Time :** Time at which VM was requested.

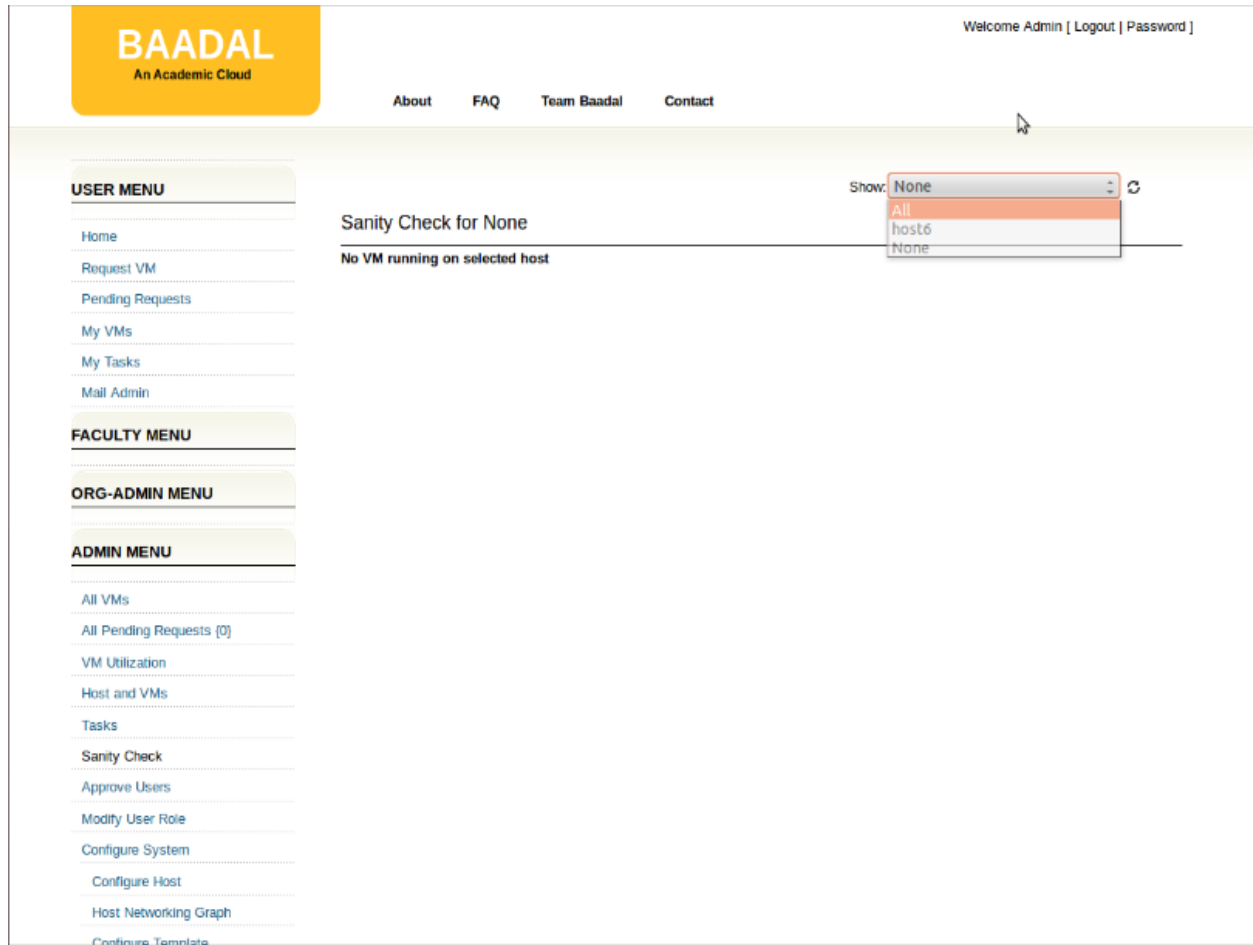
**Final Time :** Time at which task got failed.

**Action :** There are two action under this:

- Try Again : Selecting this, will again start the task.
- Ignore : Selecting this, will ignore/reject the task and it will be removed from the task queue

## 7. Title : Sanity Check

On clicking this functionality, Admin can perform sanity check on host. Following should be the output:



Show dropdown box set to None by default. This should consists of all the hosts name plus "All" in it.

Admin can see select a host or All option to perform the sanity

On selecting a host or All option in Show dropdown following should be the output:

#### USER MENU

[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

#### FACULTY MENU

#### ORG-ADMIN MENU

#### ADMIN MENU

[All VMs](#)  
[All Pending Requests \(0\)](#)  
[VM Utilization](#)  
[Host and VMs](#)  
[Tasks](#)  
[Sanity Check](#)  
[Approve Users](#)  
[Modify User Role](#)  
[Configure System](#)  
[Configure Host](#)  
[Host Networking Graph](#)  
[Configure Template](#)

Show:  

#### Sanity Check for All

Host	Status	VM Name	Message	Operations
host6	Running	temp	VM is on expected host host6	Snapshot Sanity Check

## 8. Title : Modify User Role

This utility lists all type of existing users of BAADAL. Using this functionality ADMIN can modify the role of any user, whether its student, faculty, orgadmin or admin itself. On clicking this functionality ADMIN should see the following page:

**BAADAL**  
An Academic Cloud

Welcome Admin [ Logout ] [ Password ]

About FAQ Team Baadal Contact

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

- All VMs
- All Pending Requests (0)
- VM Utilization
- Host and VMs
- Tasks
- Sanity Check
- Approve Users
- Modify User Role
- Configure System
- Configure Host
- Host Networking Graph
- Configure Template

**Modify User roles**

First Name	Last Name	Email	User Name	Organisation	Type	Action
System	User	System@baadal.tmp	system	ADMIN	<input type="checkbox"/> admin <input type="checkbox"/> faculty <input type="checkbox"/> orgadmin	<input checked="" type="checkbox"/>
Admin	User	Admin@baadal.tmp	admin	ADMIN	<input checked="" type="checkbox"/> admin <input type="checkbox"/> faculty <input type="checkbox"/> orgadmin	<input checked="" type="checkbox"/>

**First Name :** Stands for the first name of the User.

**Last Name :** Stands for the last name of the User

**Email :** It shows the email id of the user

**User Name :** Stands for username of the USER

**Type :** This is the main functionality of this utility. Admin can modify the role of the user by ticking the checkboxes of the roles. A user can have multiple roles.

**Action :** By clicking the RIGHT sign, the modification of the role of the corresponding user will be committed.

## 9. Title : Configure Host(Inside Configure System)

On clicking this functionality it redirects to the page where admin can see the list of all the hosts connected to the controller.

The screenshot displays the BAADAL Admin Dashboard. The top header features the BAADAL logo (An Academic Cloud) on the left, a user greeting 'Welcome Admin [ Logout | Password ]' on the right, and navigation links for 'About', 'FAQ', 'Team Baadal', and 'Contact'. A left sidebar contains several menu categories: 'USER MENU' (Home, Request VM, Pending Requests, My VMs, My Tasks, Mail Admin), 'FACULTY MENU', 'ORG-ADMIN MENU', and 'ADMIN MENU' (All VMs, All Pending Requests (0), VM Utilization, Host and VMs, Tasks, Sanity Check, Approve Users, Modify User Role, Configure System, Configure Host, Host Networking Graph, Configure Template). The main content area is titled 'Add New Host' and includes input fields for 'Host IP' and 'Host MAC', each with a corresponding button ('Get Details' and 'Configure'). Below this is a 'Host Details' section containing a table with one entry.

Name	IP	Status	Commands
host6	10.0.0.6	Up	

Name : This is the name of the HOST.

IP : IP address of the host

Status : “Up” means host is pingable

“Down” means host is shutdown



#### 10. Title : Add template (Inside Configure System)

Here we create a VM template Id. The VM template is already saved in the FILER. With this page we create an ID to that VM template of filer.

The screenshot displays the BAADAL web interface. At the top, there is a yellow header with the BAADAL logo and navigation links: About, FAQ, Team Baadal, and Contact. A user menu is visible on the left side, listing options like Home, Request VM, Pending Requests, My VMs, My Tasks, Mail Admin, and various faculty and admin tasks. The main content area is titled 'Manage Template' and contains a form with the following fields: Name of Template (text input), Operating System (dropdown menu showing Linux), OS Name (dropdown menu showing Ubuntu), OS Version (text input), OS Type (dropdown menu showing Desktop), Architecture (dropdown menu showing amd64), Harddisk(GB) (text input), HD File (text input), Template type (dropdown menu), Tag (text input), and Datastore (dropdown menu). A Submit button is located at the bottom right of the form.

**Name of Template :** <This is the name given to the template. It can be any name. for example, **test**>

**Operating System :** <This is dropdown list. Three values are defined. Linux, Windows, MAC>

**OS Name :** <This is a dropdown list. values are Ubuntu>

**OS Version :** < Version of the OS. We can any value to it. Genuine or anything because this has no effect on the operation>

**OS Type:** <Drop Down list. Desktop and Server>

**Architecture :** <Drop down list. for example, amd64 (64 bits), x86\_64, i386(32 bits)>

**HD File :** <Name of the template that is kept in FILER. for example, **template.qcow2**. **This should be the bootable file**>

**Template type :** <This is a dropdown list. This is basically the extension of the template. Values consist in it are, QCOW2, RAW, ISO.>

**Tag :** <Optional>

**Datastore :** <This is the datastore name which is added earlier>

Following should be the output of templates

**BAADAL**  
An Academic Cloud

[About](#) [FAQ](#) [Team Baadal](#) [Contact](#)

Welcome Admin [ Logout ] [ Password ]

**USER MENU**

[Home](#)

[Request VM](#)

[Pending Requests](#)

[My VMs](#)

[My Tasks](#)

[Mail Admin](#)

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

[All VMs](#)

[All Pending Requests \(0\)](#)

[VM Utilization](#)

[Host and VMs](#)

[Tasks](#)

[Sanity Check](#)

[Approve Users](#)

[Modify User Role](#)

[Configure System](#)

[Configure Host](#)

[Host Networking Graph](#)

[Configure Template](#)

**Manage Template**

[+Add New Template](#)

4 records found

Name of Template	Operating System	OS Name	OS Version	OS Type	Architecture	Harddisk(GB)	HD File	Template type	Tag	Datastore	
ubu	Linux	Ubuntu	12.04	Server	amd64	10	ubuntu.iso	ISO		filer	<a href="#">Edit</a> <a href="#">Delete</a>
ds1iso	Linux	Ubuntu	8.04	Desktop	amd64	2	ds1.iso	ISO		filer	<a href="#">Edit</a> <a href="#">Delete</a>
templat	Linux	Ubuntu	12.04	Desktop	amd64	10	templates.qcow2	QCOW2		filer	<a href="#">Edit</a> <a href="#">Delete</a>
rawimg	Linux	Ubuntu	12.04raw	Server	amd64	10	controller.img	RAW		filer	<a href="#">Edit</a> <a href="#">Delete</a>

## 11. Title : Add Private IP (Inside Configure System)

Private IPs pool will be defined here. IPs from this pool will be allocated to the VMs which will be created later on. If this pool is empty or fully used up then newly created VM will not get the IP and VM creation will be unsuccessful.

The screenshot displays the BAADAL web interface. At the top, there is a yellow header with the BAADAL logo and the tagline 'An Academic Cloud'. To the right of the logo, the text 'Welcome Admin [ Logout | Password ]' is visible. Below the header, there is a navigation bar with links for 'About', 'FAQ', 'Team Baadal', and 'Contact'. On the left side, there is a sidebar menu with sections: 'USER MENU', 'FACULTY MENU', 'ORG-ADMIN MENU', and 'ADMIN MENU'. The 'ADMIN MENU' section is expanded, showing options like 'All VMs', 'All Pending Requests (0)', 'VM Utilization', 'Host and VMs', 'Tasks', 'Sanity Check', 'Approve Users', 'Modify User Role', 'Configure System', 'Configure Host', and 'Host Networking Graph'. The main content area is titled 'Manage Private IP Pool' and contains a form with the following fields: 'Private Ip:', 'Mac Addr:', 'Vlan:' (a dropdown menu showing 'vlan0'), and 'Range:' (with 'From:' and 'To:' sub-fields). A 'Submit' button is located at the bottom of the form.

**Private Ip :** <Here the private Ip will be given. This private must match **VLAN** value. (This will be clarified later). for example, **10.0.0.6 (It should be correspond to vlan0)>**

**Mac Addr :** <Here the MAC Address will be given manually. for example, **52:52:00:01:15:06 >**

**Vlan :** <This is a drop down list, where 5 values of vlan are defined. for any vlan value there will be a netmask of 255.255.0.0. for example,

vlan0 : 10.0.0.0 to 10.0.0.255

vlan1 : 10.0.1.0 to 10.0.1.255

vlan2 : 10.0.2.0 to 10.0.2.255

vlan3 : 10.0.3.0 to 10.0.3.255

vlan4 : 10.0.4.0 to 10.0.4.255>

**Range :** <This is checkbox. If this is selected then above 2 will be disabled. Then we can provide a vlan value and then provide a range of IP address correspond to that vlan. On clicking submit button, a pool of IPs will be created between the range given, with start and end IP values inclusive. for example, **vlan2 , range start-10.0.2.6 and end-10.0.2.9>**

The output of configure private ip pool should be below:

**BAADAL**  
An Academic Cloud

[About](#) [FAQ](#) [Team Baadal](#) [Contact](#)

Welcome Admin [ Logout ] [ Password ]

**USER MENU**

[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

[All VMs](#)  
[All Pending Requests \[0\]](#)  
[VM Utilization](#)  
[Host and VMs](#)  
[Tasks](#)  
[Sanity Check](#)  
[Approve Users](#)  
[Modify User Role](#)  
[Configure System](#)  
[Configure Host](#)  
[Host Networking Graph](#)  
[Configure Template](#)











Manage Private IP Pool

+Add New Private IP

Search

Clear

5 records found

Private Ip	Mac Addr	Vlan	Assigned to	
10.0.2.6	A2:00:00:AB:11:64	vlan2	temp	 
10.0.2.7	A2:00:00:D8:60:A2	vlan2	Unassigned	 
10.0.2.8	A2:00:00:93:2A:E4	vlan2	Unassigned	 
10.0.2.9	A2:00:00:A9:23:51	vlan2	Unassigned	 
10.0.0.7	52:52:00:01:15:07	vlan0	Unassigned	 

## 12. Title : Add datastore (Inside Configure System)

Datastore is the storage area where all the VM templates, VM images, RRD files, VM history resides. Basically this lies in FILER which is mounted to controller and hosts

The screenshot shows the BAADAL web interface. At the top, there is a yellow header with the BAADAL logo and navigation links: About, FAQ, Team Baadal, and Contact. Below the header, there is a sidebar menu with sections: USER MENU, FACULTY MENU, ORG-ADMIN MENU, and ADMIN MENU. The main content area is titled 'Manage Datastore' and contains a form with the following fields: Name of Datastore \*, Mount IP \*, Capacity(GB) \*, Username \*, Password, Path \*, and System Mount Point \*. A Submit button is located at the bottom of the form.

Form below the **Manage Datastore**.

**Name of Datastore :** <Any name can be given to the datastore. This name is the identification of the datastore. for example, **filer**>

**Mount IP :** <This is the IP Address of the FILER. for example, **10.0.0.1**>

**Capacity(GB) :** <This is the amount of space we want to allocate to the datastore which is going to be added. for example, **100**>

**Username :** <Username of the FILER system, which will be “root” always>

**Password :** <Password of the root>

**Path :** <This is the path where VM related files has been kept. This path resides in FILER. for example, **“/baadal/data”**>

**System Mount Point :** <This is the path where the “Path” above path will be mounted.  
System mount point is same in controller and hosts. for example, “/mnt/datastore”>

Following should be the output of the datastore page, when any datastore is added to baadal:

**BAADAL**  
An Academic Cloud

[About](#) [FAQ](#) [Team Baadal](#) [Contact](#)

**USER MENU**  
[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**  
[All VMs](#)  
[All Pending Requests \(0\)](#)  
[VM Utilization](#)  
[Host and VMs](#)  
[Tasks](#)  
[Sanity Check](#)  
[Approve Users](#)  
[Modify User Role](#)  
[Configure System](#)  
[Configure Host](#)  
[Host Networking Graph](#)  
[Configure Templates](#)

**Manage Datastore**  
[+ Add New Datastore](#) 1 records found

Name of Datastore	Mount IP	Capacity(GB)	Username	Path	System Mount Point	
filer	10.0.0.1	100	root	/baadal/data	/mnt/datastore	<a href="#">✎</a> <a href="#">🗑</a>

### 13. Title : Add new security domain

Using this functionality Admin can create security domains. Following page should be the output on clicking “security domain” functionality.

The screenshot displays the BAADAL Admin interface. At the top, the BAADAL logo is on the left, and the user is logged in as 'Admin' with links for 'Logout' and 'Password'. Navigation links for 'About', 'FAQ', 'Team Baadal', and 'Contact' are in the center. A left sidebar contains a 'USER MENU' (Home, Request VM, Pending Requests, My VMs, My Tasks, Mail Admin), a 'FACULTY MENU', an 'ORG-ADMIN MENU', and an 'ADMIN MENU' (All VMs, All Pending Requests [0], VM Utilization, Host and VMs, Tasks, Sanity Check, Approve Users, Modify User Role, Configure System, Configure Host, Host Networking Graph, Configure Template). The main content area is titled 'Manage Security Domain' and contains a form with the following fields: 'Name' (text input), 'Vlan' (dropdown menu with a list of vlans), 'Visible To All' (checkbox), and 'Org Visibility' (dropdown menu). A 'Submit' button is at the bottom of the form.

Field	Value
Name	
Vlan	vlan0
Visible To All	<input type="checkbox"/>
Org Visibility	vlan2 Institute of Technology

**Name:** This stands for the name Admin want to give to the security domain which will be created.

**Vlan :** This is dropdown list. It has 5 values. ["vlan0 : 10.0.0.0", "vlan1 : 10.0.1.0", "vlan2 : 10.0.2.0", "vlan3 : 10.0.3.0", "vlan4 : 10.0.4.0"].

**Visibility To All :** This is a checkbox component. Setting this will make this security domain visible to all types of users else it will be visible to only ADMIN.

**Org Visibility :** It has two values. Baadal Admin, Indian Institute of Technology.

**Note :** “**Visibility to All**” checkbox means visibility to all users at the time of “Requesting VM” to opt under which security domain user wants his/her VM.

## Security domains

Following should be the output:

**BAADAL**  
An Academic Cloud

Welcome Admin [ Logout | Password ]

AboutFAQTeam BaadalContact

**USER MENU**  
Home  
Request VM  
Pending Requests  
My VMs  
My Tasks  
Mail Admin







**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**  
All VMs  
All Pending Requests [0]  
VM Utilization  
Host and VMs  
Tasks  
Sanity Check  
Approve Users  
Modify User Role  
Configure System  
Configure Host  
Host Networking Graph  
Configure Template

### Manage Security Domain

+Add New Security Domain3 records found

Name	Vlan	Visibility	
Private	vlan0	-	 
Infrastructure	vlan1	-	 
Research	vlan2	All	 



#### 14. Title : Launch VM (Under configure system)

Using this functionality, Admin can launch a VM. Following page should get open on using this functionality

**BAADAL**  
An Academic Cloud

[About](#) [FAQ](#) [Team Baadal](#) [Contact](#)

Welcome Admin [ [Logout](#) | [Password](#) ]

**USER MENU**

[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

**FACULTY MENU**

**ORG-ADMIN MENU**

**ADMIN MENU**

[All VMs](#)  
[All Pending Requests \[0\]](#)  
[VM Utilization](#)  
[Host and VMs](#)  
[Tasks](#)  
[Sanity Check](#)  
[Approve Users](#)  
[Modify User Role](#)  
[Configure System](#)  
[Configure Host](#)  
[Host Networking Graph](#)  
[Configure Template](#)

### Launch VM Image

VM Name:	<input type="text"/>	
RAM(MB) * :	<input type="text" value="256"/>	
CPUs * :	<input type="text" value="1"/>	
Template Id * :	<input type="text"/>	
Datastore Id:	<input type="text"/>	
VM Image Name:	<input type="text"/>	
Purpose:	<div></div>	
Security Domain * :	<input type="text"/>	
Private IP:	<input type="text"/>	
Public IP:	<input type="text" value="Not Assigned"/>	
Attach Extra Disk:	<input type="text"/>	<a href="#">Add</a>
VM Requester: *	<input type="text"/>	<a href="#">Verify</a>
VM Owner: *	<input type="text"/>	<a href="#">Verify</a>
Collaborators:	<input type="text"/>	<a href="#">Add</a>
<input type="button" value="Submit"/>		

**NOTE:**

- VM Image should be present at <Datastore mounted path>/vm images/<VM Image Name>/<VM Image Name.qcow2>

**VM Name** : Name of the VM

**RAM** : Dropdown list, value in it are in MBytes.

**CPUs** : This stands for count of vCPUs for the VM

**Template Id** : This is the “id” corresponding to the template which is added in the template

**Datastore Id** : “id” of the datastore where VM Disk will be kept

**VM Image Name** : Name given to the VM image. Make sure that

“/mnt/datastore/vm\_image/<this name>/<this name>.qcow2” should exists.

**Purpose** : Optional

**Security domain** : Select between Research, Infrastructure, Private and any other security domains added to baadal

**Private Ip** : Manually providing private Ip to the VM. (Keep in mind, this Ip must belong to the chosen security domain). It can be left empty, then random Private Ip from Private Ip pool will be given to this VM.

**Public Ip** : Provide Public Ip to the VM

**Add extra disk** : Any extra disk admin want to attach to the VM

**VM requester** : Name of the VM requester. Then verify whether user with this name exists or not

**VM owner** : Owner of the VM. Then verify whether user with this name exists or not

**Collaborators** : Add multiple collaborators to the VM

**Users FR : Here users include student, faculty and orgadmin**

### **Title : Types of User**

In baadal orchestration there are 4 types of users, vis a vis

1. Student
2. Faculty
3. Organization Admin (Ord Admin)
4. Admin

All these users can request for VM. The basic type of user is Student. How it looks like when a student logs in into baadal. It can be seen in the below output:

The screenshot displays the Baadal web application interface. At the top left, there is a yellow logo with the text "BAADAL" and "An Academic Cloud" below it. To the right of the logo, there is a navigation bar with links: "About", "FAQ", "Team Baadal", and "Contact". In the top right corner, there is a user greeting: "Welcome neeraj [ Logout | Password ]". On the left side, there is a "USER MENU" with the following items: "Home", "Request VM", "Pending Requests", "My VMs", "My Tasks", and "Mail Admin". The main content area is titled "Welcome to Baadal" and contains the following text: "Baadal is a management and orchestration software for the IITD private cloud for high performance computing based on:" followed by a bulleted list of features: "3 blade servers each with 2x6 core Intel(R) Xeon(R) CPU X5670 @ 2.93GHz and 32 GB RAM.", "A 10Gbps ethernet backbone.", "400 GB of virtualized storage based on a NetApp 3210V NAS and HP EVA6400 SAN with FC disks.", and "Open source virtualization technology based on KVM. It can also support other popular virtualization technologies like Xen and VmWare." Below this, it says "Some of the main features of Baadal are:" followed by another bulleted list: "Dynamic resource scheduling and power management.", "Facilities for suspend, resume, shutdown, power off, power on and specifying resource requirement of virtual machines.", and "Dynamic resource utilization monitoring."

**BAADAL**  
An Academic Cloud

Welcome neeraj [ Logout | Password ]

About FAQ Team Baadal Contact

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

### Welcome to Baadal

Baadal is a management and orchestration software for the IITD private cloud for high performance computing based on:

- 3 blade servers each with 2x6 core Intel(R) Xeon(R) CPU X5670 @ 2.93GHz and 32 GB RAM.
- A 10Gbps ethernet backbone.
- 400 GB of virtualized storage based on a NetApp 3210V NAS and HP EVA6400 SAN with FC disks.
- Open source virtualization technology based on KVM. It can also support other popular virtualization technologies like Xen and VmWare.

Some of the main features of Baadal are:

- Dynamic resource scheduling and power management.
- Facilities for suspend, resume, shutdown, power off, power on and specifying resource requirement of virtual machines.
- Dynamic resource utilization monitoring.

In the LEFT hand side we can see the functionality given to basic user. We will talk about it in detail.

### Faculty as a user:

Faculty is also a user with some functionality of being a faculty, over student. We can see in the below output :

The screenshot displays the Baadal web interface. At the top left is the Baadal logo with the tagline "An Academic Cloud". To the right, a navigation bar includes links for "About", "FAQ", "Team Baadal", and "Contact". A dark grey button labeled "Logged in" is positioned in the top right corner. On the left side, a sidebar menu is visible, divided into two sections: "USER MENU" and "FACULTY MENU". The "USER MENU" section lists "Home", "Request VM", "Pending Requests", "My VMs", "My Tasks", and "Mail Admin". The "FACULTY MENU" section lists "Pending Approvals (0)". The main content area on the right is titled "Welcome to Baadal" and contains a list of hardware specifications and a list of main features.

**BAADAL**  
An Academic Cloud

Navigation: About, FAQ, Team Baadal, Contact

Logged in

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

**FACULTY MENU**

- Pending Approvals (0)

**Welcome to Baadal**

Baadal is a management and orchestration software for the IITD private cloud for high performance computing based on:

- 3 blade servers each with 2x6 core Intel(R) Xeon(R) CPU X5670 @ 2.93GHz and 32 GB RAM.
- A 10Gbps ethernet backbone.
- 400 GB of virtualized storage based on a NetApp 3210V NAS and HP EVA6400 SAN with FC disks.
- Open source virtualization technology based on KVM. It can also support other popular virtualization technologies like Xen and VmWare.

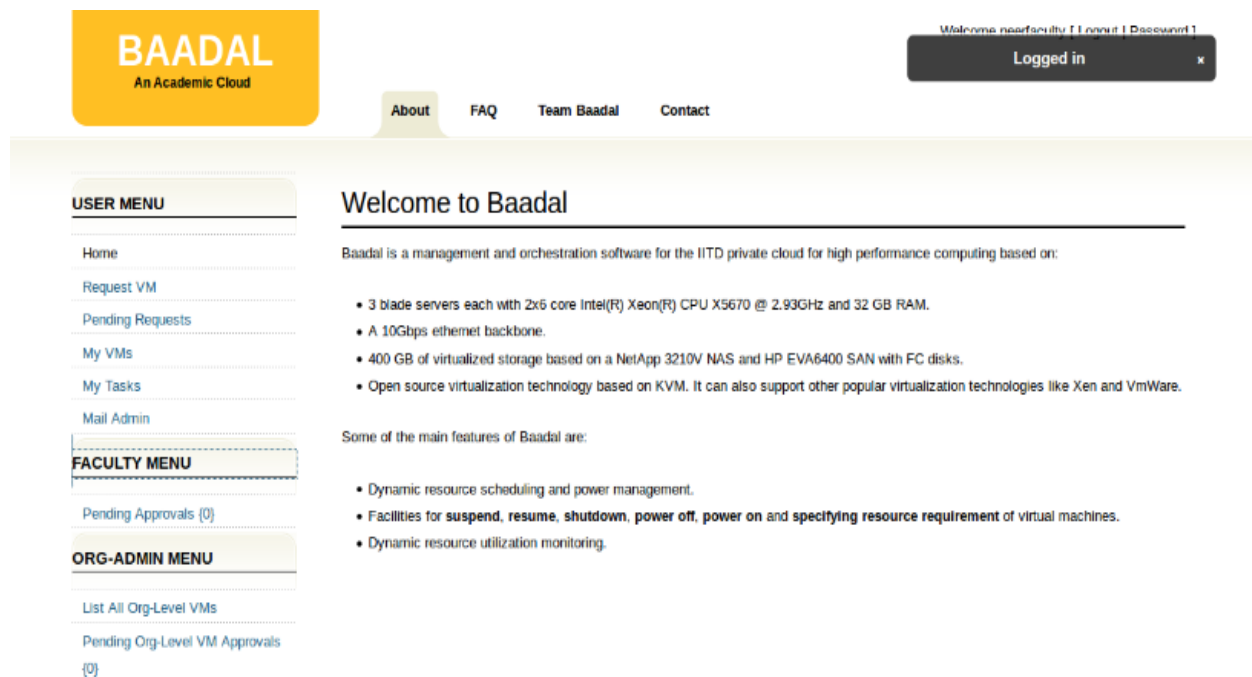
Some of the main features of Baadal are:

- Dynamic resource scheduling and power management.
- Facilities for **suspend, resume, shutdown, power off, power on** and **specifying resource requirement** of virtual machines.
- Dynamic resource utilization monitoring.

As we can see on the LEFT side of the above output. Faculty has all the functionality of a basic user plus he has the functionality of getting the request from basic user under him

Org Admin as a user:

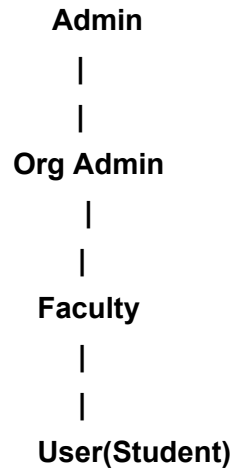
It also has user functionality, faculty. It looks like below:



Org Admin has two functionalities

1. **List all Org Level VMs** : It shows all the VMs of Org Admin level.
2. **Pending Org Level VM Approvals** : It shows the request which comes from faculty.

### **Hierarchy level of all type of users**



### **Request Hierarchy :**

User to faculty

faculty to oeg admin (if faculty approves)

org admin to admin(if oeg admin approves)

Then admin can approve or reject the request

## 1. Title : Request hierarchy

When a basic user requests for a VM it goes to faculty and it looks like this at faculty level.

BAADAL  
An Academic Cloud

Welcome fac [ Logout | Password ]

About FAQ Team Baadal Contact

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

**FACULTY MENU**

- Pending Approvals (1)

Install VM (1) Clone VM (0) Attach Disk (0) Edit Configuration (0)

Requested By	VM Name	vCPUs	RAM	HDD	Public IP	Security Domain	Action
neeraj rawat	ds33	1 CPU	0.25 GB	2 GB	✖	Research	Approve   Reject   Edit

Here the faculty can approve, reject or edit the request.

- If it rejects the request then request will be removed from the request queue.
- Edit request will be discussed below
- If it Approve the request then it goes to Org Admin

#### USER MENU

[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

#### FACULTY MENU

[Pending Approvals \(0\)](#)

#### ORG-ADMIN MENU

[List All Org-Level VMs](#)  
[Pending Org-Level VM Approvals \(1\)](#)

**Install VM (1)** [Clone VM \(0\)](#) [Attach Disk \(0\)](#) [Edit Configuration \(0\)](#)




Requested By	VM Name	vCPUs	RAM	HDD	Public IP	Security Domain	Action
neeraj rawat	dsi33	1 CPU	0.25 GB	2 GB	✖	Research	<a href="#">Approve</a>   <a href="#">Reject</a>   <a href="#">Edit</a>

Here the org admin can approve, reject or edit the request.

- If it rejects the request then request will be removed from the request queue.
- Edit request will be discussed below
- If it Approve the request then it goes to Admin as below



**USER MENU****FACULTY MENU****ORG-ADMIN MENU****ADMIN MENU**[All VMs](#)[All Pending Requests \(1\)](#)[VM Utilization](#)[Host and VMs](#)[Tasks](#)[Sanity Check](#)[Approve Users](#)[Modify User Role](#)[Configure System](#)[Shutdown Baadal](#)**Install VM (1)** [Clone VM \(0\)](#) [Attach Disk \(0\)](#) [Edit Configuration \(0\)](#)

Requested By	Collaborators	Organisation	VM Name	vCPUs	RAM	HDD	Public IP	Security Domain	Approval Status	Action
neeraj rawat	fac fac	IITD	dsID9	1 CPU	0.25 GB	2 GB	X	Research	fac fac IITD Admin	  

Here the admin when approves the request, it gets placed into task queue.

Under “Action:



Approved request



Reject request



Edit request

## Edit Request:

Faculty , orgadmin and Admin . These all have this functionality to edit the request which comes from the user below in the hierarchy.

Edit request page looks like below

**BAADAL**  
An Academic Cloud

Welcome fac [ Logout ] [ Password ]

AboutFAQTeam BaadalContact

**USER MENU**  
Home  
Request VM  
Pending Requests  
My VMs  
My Tasks  
Mail Admin

**FACULTY MENU**  
Pending Approvals (1)

### Edit Pending Request

VM Name:	ds129
Request Type:	Create VM
Template Id:	Ubuntu 8.04 Desktop amd64 2 ▾
RAM(MB):	256 ▾
CPUs:	1 ▾
HDD(GB):	2
Extra HDD(GB):	0
Security Domain:	Research ▾
Assign Public IP:	<input type="checkbox"/>
Purpose:	
	Submit

Here the resources of the VM can be edited by the faculty, orgadmin or Admin.

## 2. Title : Request VM

A user can request for a VM to the user sitting above him/her. A user can be anyone (student, faculty, org admin or admin himself) . Below is the output for requesting a VM.

**BAADAL**  
An Academic Cloud

Welcome neeraj [ Logout | Password ]

AboutFAQTeam BaadalContact

**USER MENU**  
Home  
Request VM  
Pending Requests  
My VMs  
My Tasks  
Mail Admin

### Request VM

VM Name * :	<input type="text"/>	
Template Id * :	Ubuntu 12.04 Desktop amd64 ▾	
Configuration: * :	1 CPU, 0.25GB RAM, 10GB HDD ▾	
Extra HDD(GB):	<input type="text"/>	
Purpose:	<div></div>	
Security Domain * :	Research ▾	
Assign Public IP:	<input type="checkbox"/>	
Faculty Approver: * :	<input type="text"/>	Verify
Collaborators:	<input type="text"/>	Add
<input type="button" value="Submit"/>		

**VM Name** : The name for the VM user want to give. It should be unique from the VM names which are already requested or running.

**Template Id** : This belongs to the type of template which the user want to install for its VM.

**Configuration** : This contains predefined combinations of { CPU(count of vCPU), RAM (in Gb), HDD(in Gb) }. User can select anyone from it for his/her VM

**Extra HDD** :User can ask for extra disk if he/she found no suitable HDD in any of the combinations in **Configuration**

**Purpose** : For what purpose VM is required. This is optional.

**Security Domain** : Under which domain VM should be created. For user only one domain is activated by Admin, that is Research.

**Assign Public IP** : Whether or not, user want a public ip for the VM.

**Faculty Approve** : Under whom student is working or to whom student is making his request for the VM. Faculty name should be there in the database and it has to be verified first before going further.

**Collaborators** : What all users can be collaborators of the VM, it can be added to the VM

### 3. Title : My VMs

User can see his/her VMs here and also has access to the settings of the VM:

The screenshot shows the BAADAL user interface. The header includes the BAADAL logo (An Academic Cloud) and navigation links: About, FAQ, Team Baadal, and Contact. The user is logged in as 'neeraj' and can click on 'Logout' or 'Password'. A 'USER MENU' is visible on the left, containing links for Home, Request VM, Pending Requests, My VMs, My Tasks, and Mail Admin. The 'My VMs' section displays a table with the following data:

Name	Owner	Private IP	Public IP	RAM	vCPUs	Status	Settings
dsl20	neerfaculty faculty	10.0.2.10	Not Assigned	0.25 GB	1 CPU	Running	

It shows the list of all the VMs under user

**Name** : Name of the VM

**Owner** : Name of the user to whom it was requested. It can be faculty or orgadmin or admin.

**Private IP** : Private IP assigned to the VM

**Public IP** : If public ip is assigned to the VM then it would be shown here, otherwise it shows “Not Assigned”.

**RAM** : RAM in gb

**CPU** : Count of vCPUs

**Status** : status of VM. Running is this case

**Settings** : It redirects to the setting page of the VM. It looks like below

**BAADAL**  
An Academic Cloud

Welcome neeraj [ Logout ] [ Password ]

About FAQ Team Baadal Contact

**USER MENU**

- Home
- Request VM
- Pending Requests
- My VMs
- My Tasks
- Mail Admin

**VM Configuration**

Name	HDD	RAM	VCPUs	Operating System	Private IP	Public IP	Security Domain	Status
ds20	2 GB	256 MB	1 CPU	Ubuntu 8.04 Desktop amd64	10.0.2.10	Not Assigned	Research	Running

**Purpose :**

**VM Operations**

Snapshot(s) [Configure Snapshots](#)

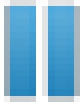
Here we can perform operation on VM. Operations are given under “VM Operations”.



This is for taking the snapshot of the VM



This redirects to the page where the user can see the performance of the VM, resources used by the VM on hourly, daily, weekly, monthly or yearly basis



This is used to pause the VM



This is for gracefully shutdown of the VM.



Forcefully shutdown of the VM



For the grant of VNC



To see the VM history. It redirects to the history page

**In case user is an Admin. VM setting page is as below**

#### USER MENU

[Home](#)  
[Request VM](#)  
[Pending Requests](#)  
[My VMs](#)  
[My Tasks](#)  
[Mail Admin](#)

#### FACULTY MENU

[Pending Approvals \(0\)](#)

#### ORG-ADMIN MENU

#### ADMIN MENU

[All VMs](#)  
[All Pending Requests \(0\)](#)  
[VM Utilization](#)  
[Host and VMs](#)  
[Tasks](#)  
[Sanity Check](#)  
[Approve Users](#)  
[Modify User Role](#)  
[Configure System](#)  
[Shutdown Baadal](#)

#### VM Configuration

Name	HDD	RAM	VCPUs	Operating System	Private IP	Public IP	Security Domain	Status
dsbrios	2 GB	256 MB	1 CPU	Ubuntu 8.04 Desktop amd64	10.0.2.19	Not Assigned	Research	Running

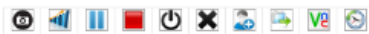
Host: 10.0.0.5

Purpose :

#### VM Users

Admin User ☒ neeraj rawat ☒

#### VM Operations



Snapshot(s)

[Configure Snapshots](#)

**Extra VM operations under Admin are as below:**



This is used to add a user to VM. After adding that user will be seen below the “VM users” (above VM Operations)



It is used to delete the VM. Only Admin can delete any VM



It is used to migrate the VM.

#### 4. Title : Pending Request

Here a user can see the status of his/her request for VM. Below should be the output:

The screenshot displays the BAADAL web interface. At the top left is the BAADAL logo with the tagline 'An Academic Cloud'. To the right, a user is logged in as 'neeraj' with links for 'Logout' and 'Password'. A navigation bar contains links for 'About', 'FAQ', 'Team Baadal', and 'Contact'. On the left, a 'USER MENU' sidebar lists options: Home, Request VM, Pending Requests (highlighted), My VMs, My Tasks, and Mail Admin. The main content area features a header with action buttons: 'Install VM (1)', 'Clone VM (0)', 'Attach Disk (0)', and 'Edit Configuration (0)'. Below this is a table showing a single pending request.

Requested By	Faculty	VM Name	vCPUs	RAM	HDD	Public IP	Security Domain	Status
neeraj rawat	neer/faculty faculty	dsi20	1 CPU	0.25 GB	2 GB		Research	Waiting for faculty approval

**Requested by** : Name of the user who has made the request

**Faculty** : Name of the faculty to whom the user has made the request.

**VM Name** : Name of the VM given by the user during making the request

**vCPU** : Count of vCPU user has requested.

**RAM** : RAM in gb, user has requested.

**HDD** : Hard Disk size in gb, user has requested.

**Public Ip** : Whether user has requested for Public Ip or not. In this case user has not.

**Security Domain** : Research

**Status** : waiting for approval or rejection from the faculty.



## 5. Title : Mail Admin

In case a user want to send an email to admin of the baadal. Then below is the output of the mail admin functionality

The screenshot displays the BAADAL web application interface. At the top, a yellow header bar features the BAADAL logo and the tagline 'An Academic Cloud'. To the right of the logo, there is a user greeting 'Welcome neeraj' and links for 'Logout' and 'Password'. Below the header, a navigation bar includes links for 'About', 'FAQ', 'Team Baadal', and 'Contact'. On the left side, a 'USER MENU' is visible, listing options: Home, Request VM, Pending Requests, My VMs, My Tasks, and Mail Admin. The main content area is titled 'Mail Admin' and contains a form for sending emails. The form includes a 'Type' field with three radio button options: 'Report Bug' (selected), 'Log Request', and 'Lodge Complaint'. Below this is a 'Subject' field, followed by a 'Message' field. At the bottom of the form is a 'Send Email' button.

This functionality is provided all type of users (admin also).