

This software has been customized and configured as per the requirement of DAE-HO, Mumbai. Data files, table spaces, schema, tables and views for payroll database have been created on database server, deployed on Anunet. Modifications in forms and reports were carried out as per the requirement at DAE-HO. Codification for master tables for maintaining details of employees, entitlements, deductions, head of accounts and various recovery rates have been done. Data migration with proper data type casting from existing FoxPro system to new Oracle system was done with export and import utilities and PL/ SQL scripts.

This system has been integrated with the Personnel System of DAE-HO for using information of the employees, to eliminate redundancy of data. Additional reports were developed as per their requirement for generating section wise summary, multiple bank wise schedule, division wise bank schedule, modified consolidated statement of pay bill (for IAS officers) etc. The software is in regular use, since last three months.

**G) Enhancements and deployment of software for on-line submission of applications for Recruitment at RRCAT and RRCAT Ph.D. Programme 2014:**

Web based software for on-line submission of applications on Internet was fine tuned as per the revised application formats of advertisements for recruitment at RRCAT. The software was deployed for two more advertisements for regular recruitment - Advertisement No. 'RRCAT-5/2013' and 'RRCAT-6/2013'. Provision has been made in the software to generate different application form for different post codes, within the single advertisement. Provision has also been made for source code versioning for various advertisements for future reference and rapid deployment of similar type of advertisement.

Web based software for on-line submission of applications on Internet was fine tuned as per the application format for RRCAT Ph.D. programme – 2014 and deployed on Internet.

The administrative interface on RRCATInfonet has been enhanced to provide statistical information and with graphical representation in the form of bar chart, for applications received on-line and entered manually as shown in figure I.2.6. Deployment of these software applications has reduced data entry workload of staff at recruitment section.

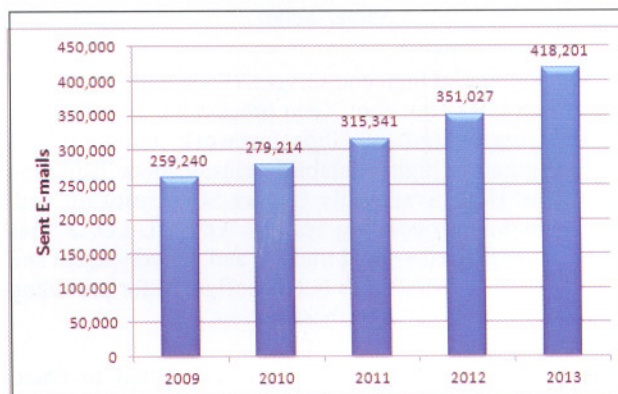
*Reported by:*

*Alpana Rajan (alpana@rrcat.gov.in) and Anil Rawat*

**I.3: Developments in Networking and Communication at RRCAT**

**A) Design, Development and Commissioning of high performance and high availability cluster based email server setup:**

With rapid growth of email communication as the most convenient, fast, reliable and legally accepted mode of communication, organizational level email services are required to be responsive and reliable. In RRCAT also, requirement of email service as an essential mode of communication, has increased rapidly over the last few years. The bar graph in figure I.3.1, depicts the rate of growth of mails sent by RRCAT users in last five years. The graph shows that there is great amount of dependency on email services for communication, and it is increasing day by day. Thus, there is a need to provide reliable, fast and high capacity email storage to users.



*Figure I.3.1: Graph depicting yearly volume of emails sent by RRCAT users for last five years*

In view of the requirements, a state of the start, high performance and high availability cluster based email server setup is commissioned. The complete email setup has been designed and developed in house using Freeware Open Source Software (FOSS) components. Email server setup is released to users with enhanced features. The newly added features are (a) Increased disk quota for each user, (b) Auto insertion of TO/ CC/ BCC fields based on search on Email-ID



*Figure I.2.6: Management information of on-line Recruitment Advertisements*



or partial string in name while composing a mail, (c) Single login restriction per PC at any instance, (d) Downloading of multiple attachments as a single zip file, (e) Single email delivery per unique message, (f) Check for matching authenticated 'loginID' and 'From' fields, while sending mails.

Figure I.3.2 depicts complete block schematic of the email server setup. The new email server setup consists of the following components:

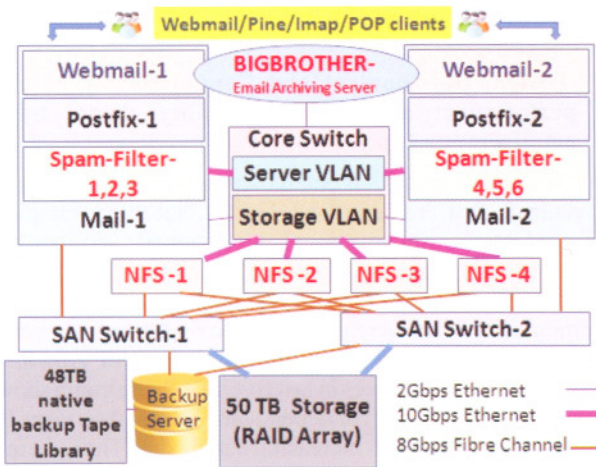


Figure I.3.2: Block schematic of the cluster based Email Server Setup

- 1) Two number of high end servers, (Each with 2 no. of 64 bit, 2.8 GHz Hex core Xeon processors, 32 GB RAM and aggregated 8 Gbps network connectivity) configured in high availability cluster mode using the Redhat High Availability Cluster Suite software with Centos-6.3 as operating system. "QMAIL-LDAP" has been configured as mail transfer and delivery agent and "COURIER-IMAP" has been configured for providing IMAP/ POP services on these servers.
- 2) High capacity (50 TB) storage, connected to email servers, using two modes of connectivity. One using high bandwidth (8Gbps/ channel) dual fibre channels as SAN (Storage Area Network) storage and other using the 10 Gbps ethernet connectivity using the NAS (Network Attached Storage) accessible using the NFS (Network File System) servers NFS-1 to NFS-4 as shown in figure I.3.2. The SAN storage is used for providing large mail boxes to the users and the NAS storage is used for storing webmail profiles, session information and it also acts as one level of backup for user mailbox and system configuration files.

- 3) Two number of webmail (nginx version 1.4 with squirrelmail, version 1.4.22), send mail transfer protocol (postfix version 2.6) servers and a farm (six number) of spam filter (SPAMASSASSIN version 3.3.1) servers, have been configured in load balanced and failover mode. All these servers have been configured as virtual servers using linux KVM (Kernel based Virtual Machine version 0.12) virtualization tool.
- 4) The 'bigbrother' setup is used to archive all email transactions being made by users. A web based facility for searching and retrieval of emails has also been designed and developed for the email system administrator.
- 5) A mechanism to perform automated backup of user data in D2D2T (Disk to Disk to Tape) organizational backup setup. Backup schedules have been designed to perform weekly, monthly and yearly full backups and differential backup of the user mailboxes.

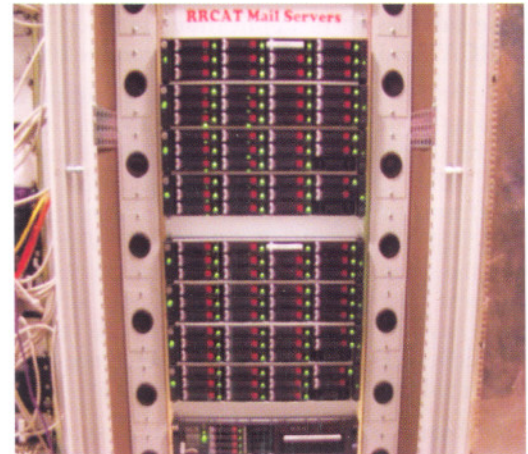


Figure I.3.3: Rack view of newly commissioned Email Server Setup

The new email server setup has been configured for optimal utilization of the hardware resources, by using virtualization concepts, thus contributing towards green IT (Information Technology) initiatives of the centre. The configuration of virtual machines and the cluster has improved the performance and reliability of the email services. The configuration of spam filtering server farm with six number of virtual machines has improved the spam filtering rate. The impact on the users is multifold and the setup gives them a jitter-free access to email services. Figure I.3.3 shows a view of the complete email server setup mounted in a rack. Figure I.3.4 is a snapshot of the first page of the new webmail service released to the users.





Figure I.3.4: Snapshot of Webmail interface of new Email Setup

**B) Commissioning of high performance and high availability Internet squid proxy server setup:**

New high performance Internet squid proxy server setup is configured in high availability cluster mode with two servers (each with 2 no. of 64 bit, 2.8 GHz Hex core Xeon processors, 32 GB RAM and aggregated 8 Gbps network connectivity). Each server is loaded with Centos (version 6.3) operating system and running four squid processes per server, to maximize the utilization of hardware resources. Figure I.3.5, depicts the block diagram, showing interaction between various components of this setup.

of hard disk, formatted in rierer file system for caching purposes. Server end virus filtering capabilities are integrated in the setup with the help of I-CAP (version 0.2.5) and SquidclamAV (version 6.10) as interface to the popular open-source and freeware ClamAV (version 0.98.2) antivirus software. The ClamAV virus database is updated on daily basis. Content filtering is achieved using Squid Guard (version 1.4). The blocking list has been updated as per RRCAT content access policy. The server has also been configured to block TOR (anonymity network) proxy access, TEAMVIEWER access and access to known MALWARE infected websites, based on the IP (Internet Protocol) reputation list. The CSF (ConfigServer Security and Firewall) firewall (version 6.43) has been configured to enhance security of the proxy server setup. The proxy access logging setup has been reconfigured to work with the new set of servers. The entire setup has been created using freeware open-source software tools.

**C) Commissioning of six number of high speed switches with 1 Gbps ports on Internet and Anunet DMZs (De Militarized Zones):**

Internet and Anunet setup connectivity has been enhanced by commissioning of six high speed (1 Gbps per port) ethernet switches. This has enhanced connectivity of RRCATNet to Internet and Anunet networks, from the earlier speed of 100 Mbps to 1Gbps. Commissioning of fiber connectivity between switches of Internet DMZs (02 number), Intranet DMZ (01 number) and Anunet DMZ (01) is also completed. Various DMZ VLANs (Virtual Local Area Networks) have also been extended to Information Technology Building-B. This has enabled RRCATNet server DMZ, for commissioning of servers in any of the DMZs in any of the two buildings (IT Building-A and IT Building-B), thus achieving high availability of services even in case of failure of IT setup in one of the buildings.

**D) Commissioning of redundant virtualized servers in place of physical servers:**

RRCATNet, complies to the security related restrictions of running one service on one server, wherever necessary. To provide reliable services, mostly high end servers are commissioned. In most of the cases, this leads to underutilization of resources, since the services do not need those many resources as are provided, even in entry level servers. With an eye towards the green IT implementations at the centre, we have started converting the servers into virtual servers, whereby one physical server can host multiple virtual servers. In our bid in this direction, 35 number of virtual servers (including webmail, web, mail, dns, authentication etc.) have been commissioned till date. These servers mostly act as redundant servers to take care of services in case of failure of the main server.

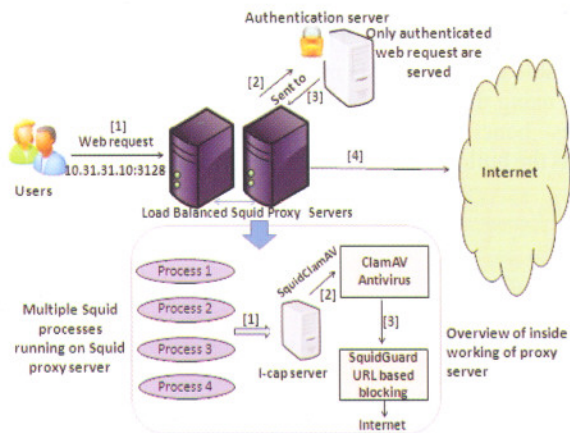


Figure I.3.5: Block diagram, depicting various components and the interaction between components of the Internet squid proxy server setup

Both the proxy servers are configured with latest stable version of squid (version 3.3), freeware open-source proxy application software. Each server is configured with 1.2 TB



**E) Commissioning of new servers for Anunet DMZ:**

Anunet setup in RRCAT is reconfigured by commissioning new Anunet DMZ firewall, mail and name servers for isolating Anunet servers from RRCAT intranet servers. Two name servers, serving "anunet.in" and other DAE units sub domains, have been setup to synchronize the name records with root level name server hosted at BARC. RRCAT related web services on Anunet can be accessed on any PC connected in any DAE unit, using the URL <http://www.rrcat.anunet.in>. Figure I.3.6, is a snapshot of the home page, displaying web services available in RRCAT, which are accessible over Anunet.



Figure I.3.6: Snapshot of home page, displaying services available in RRCAT, accessible over Anunet

**G) Expansion of communication network:**

Total 89 numbers of new telephone connections were provided at various locations in RRCAT campus (SCLS building, Accelerator Magnet Technology Division Building, UHV Lab IMA assembly hall, Colony, ADL).

*Reported by:  
S. S. Tomar (tomar@rrcat.gov.in), Alpna Rajan  
and Anil Rawat*

**I.4: Construction and Services**

**A) Making of Ultra High Vacuum and Magnet fabrication Lab Buildings:**

Ultra High Vacuum and Magnet Fabrication Labs(UHV-MFL) have been designed and constructed as two RCC (Reinforced Cement Concrete) blocks, joined by a central utility wing, which facilitates common entrance & general utility services for both the labs. The MFL bldg., has a high bay of 14.4 meters height, with a provision for 50T capacity EOT (Electric Overhead Travelling) crane. RCC frame is constructed with stepped column to support crane girder. The crane girder is designed and fabricated using built up section for critical combination of loads, including, movement of maximum capacity load in lifted condition. The MFL bldg., had diverse building requirement of fabrication and testing. The fabrication lab necessitates workshop environment, whereas test lab required air conditioned environment with dust controlled finishes and foundation with vibration isolation. The diverse requirements have been met with proper planning. The test lab has been provided with removable hatch to enable mounting of heavy magnet on test bench using the EOT crane. After the erection of magnet on the test bench, hatch is covered for testing. Figure I.4.1 depicts the building plan of the UHV-MFL building.

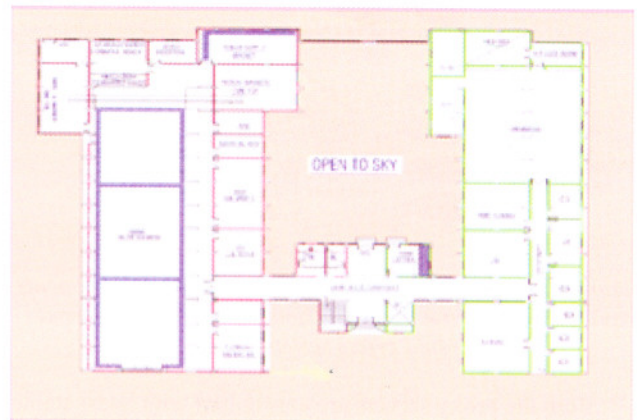


Figure I.4.1: Building Plan

**F) RRCATNet Expansion and Upgradation:**

Commissioning of one number of OFC (Optical Fibre Cable) segment, from Information Technology Building-B to MFL and UHV building is completed. This will provide redundant physical layer network connectivity to MFL, UHV and SCRF buildings.

Expansion of network was carried out in (i) Indus User Hall building, where one 24-port switch was upgraded to 48-port switch, (ii) in Indus-2 building, where one 24-port was upgraded to 48-port switch and (iii) in UHV and MFL buildings, where a new 24-port switch was installed. In addition to this, nine new network ports were added in various other buildings, as per the user requirements.