



## I.1 Computing and information management developments at RRCAT

### A) Commissioning of 16 nodes (32 processors) Xeon based HPC cluster Aryabhata:

Sixteen nodes (32 processors) Intel Xeon based High Performance Computing (HPC) cluster named as 'Aryabhata', is commissioned for computing applications. HPL (High Performance Linpack) benchmark for this cluster resulted in 262 gigaflops peak computing power. The cluster is configured with 64 bit Red Hat Enterprise Linux AS4 operating system, resource manager 'Torque' and job scheduler 'Maui'. Each node contains two dual core Xeon processors @ 3.73 GHz with 4 MB L2 cache per processor, 4 GB memory and Gigabit network interface. The total number of processors on this cluster is 32 and each processor is dual core with hyper threading. All the nodes are HP DL 380 G5 series servers.

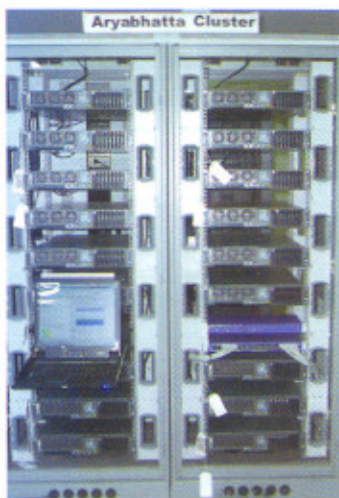


Fig.I.1.1: 16-nodes HPC cluster-Aryabhata.

Intel Fortran compiler (ifort), GNU Fortran 77 compiler (g77), GNU Fortran 90/95 compiler (gfortran), Intel C Compiler (icc), GNU C & C++ compiler (gcc & g++) are installed on this cluster. Parallel processing libraries installed on this cluster are mpich2-1.0.5 for g77, gfortran & ifort and mpich-1.2.7 for g77, gfortran & ifort. In addition to these compilers and parallel processing libraries, parallel numerical libraries including Intel Math Kernel Library, LAPACK, CBLAS, f77BLAS, ATLAS are also installed on the cluster.

As per the user requirements, parallel applications WIEN97 [computation of electronic structure of solids within density functional using Linearized Augmented Plane Wave (LAPW) method] and CPMD (Car-Parrinello Molecular Dynamics - Electronic Structure and Molecular

Dynamics Program) are successfully ported and running on 'Aryabhata'.

### B) Commissioning of HPC clusters as part of DAEGrid:

Two cluster have been installed and made operational as part of DAEGrid. The operating system is Scientific Linux version 4.4 on both the clusters. Intel Fortran V 9.0, gcc, gfortran compilers, Math Kernel library v 8.0, parallel processing library mpich-1.2.7 are installed on both the clusters. Genius based grid-portal on Scientific Linux has been installed on these clusters. Users from RRCAT can submit their parallel and sequential applications on the resources available under DAEGrid, using grid-portal made operational in User Hall of Computer Centre.

**Daksha:** Eight node cluster named "Daksha" has been installed and made operational as part of DAEGrid. Each node contains Intel dual core Xeon processor @ 3.60 GHz with 2 MB cache, 4 GB memory and gigabit network interface.

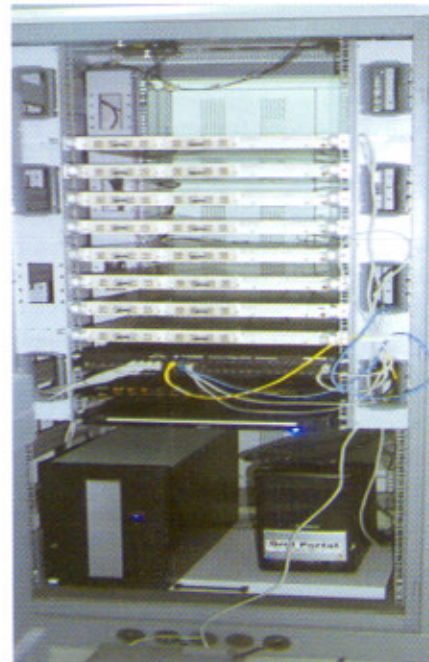


Fig.I.1.2: 8-nodes HPC cluster - Daksha.

**Ramanujam:** Sixteen nodes (32 processors) high performance computing cluster "Ramanujam" has been installed and added to the DAEGrid. Each node comprises of two dual core Xeon processors @ 3.73GHz, 4 MB L2 cache per processor, 4 GB memory and Gigabit network interface. The total number of processors on this cluster is 32 and each processor is dual core with hyper threading. All the nodes are HPDL 380 G5 series servers.



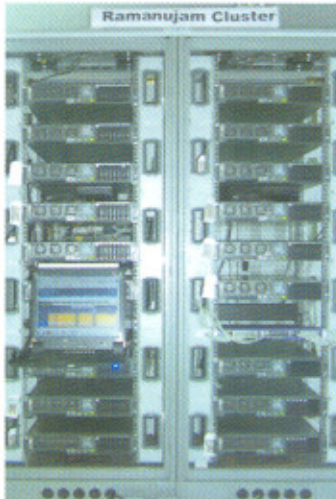


Fig.1.1.3: 16-nodes HPC cluster-Ramanujam.

### C) Configuration of MRTG on all computing servers:

Multi Router Traffic Grapher (MRTG), an open source web based software has been configured for all computing servers to monitor the load of CPU, memory usage, hard disk usage and network traffic. The data is stored in round-robin database, so that system storage footprint remains constant over time. The software records the data in a log on the client along with previously recorded data and creates the HTML document detailing the traffic for the devices such as CPU, memory and network in graphical form.

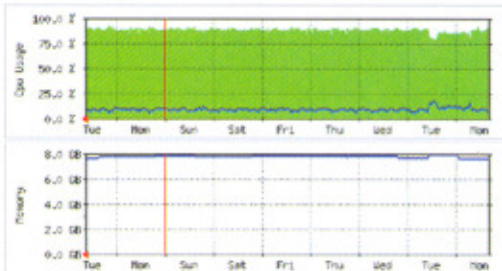


Fig.1.1.4: CPU and Memory usage of chi (HP Alpha ES45) server.

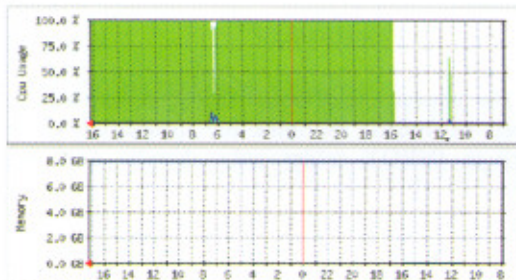


Fig.1.1.5: CPU and Memory usage of epsilon (Intel Itanium 1.6 GHz) server.

### D) Migration of existing client / server based Information Systems to web / n-tier based architecture :

Various information management systems for RRCAT Administration, Accounts, and IRPSU are developed and maintained by Computer Centre. These systems were working on client/ server (two-tier) architecture. These days zero client deployment concept (web based platform using n-tier architecture) is being used world-wide, as it provides a platform which is simpler to implement, administer and accessible to wider user base.

Hardware infrastructure required for migration to n-tier architecture was procured and commissioned. Two Xeon @ 3.4 GHz with 4 GB RAM as Oracle 10g Database Servers, two Xeon @ 3.4 GHz with 4 GB RAM as Application Servers and one Xeon @ 3.2 GHz with 2 GB RAM for Identity & Access Management were installed. Software products including Oracle Standard Database 10g (10.1.2) for backend database, Oracle Developer Suite 10g (10.1.2) for development and Oracle Application Server 10g (10.1.2) for deployment were procured. The planning related to deployment topologies, which included application deployment, central services and administration, unified login across information management system of Oracle 10g infrastructure and mid-tier was done. Migration of data of purchase information system from Oracle 7.3 database to Oracle 10g SE database was done as proof of concept. Then migration strategy for successful web-deployment using Oracle platform was finalized.

Migration of forms and reports, application deployment, central services and administration, unified login across information management system of Oracle 10g infrastructure and mid-tier were completed. Migration and re-engineering of all applications related to Administration, Integrated Purchase-Stores-Audit and Integrated Accounting System to Oracle 10g platform was completed with single sign-on functionality. Single sign-on feature was implemented using Oracle Identity Management which provides the infrastructure to centrally manage user and application identities, their authorizations and other policy decision points. Data was migrated from Oracle 7.3 to Oracle 10g database and Oracle Internet Directory was configured for authentication.

Comprehensive training to all the users was provided and now the information management systems of Administration, Accounts and IRPSU are successfully running on Oracle 10g platform. The whole exercise has resulted in sustainable information systems compliant with international standards.



**E) Enhancements to RRCATInfonet:**

Authenticated module for Project Monitoring has been released on RRCATInfonet, which provides various reports for monitoring the procurement status of XI Plan projects. The online information is made available from the Integrated Purchase-Stores-Audit System and Integrated Accounting Software. The access is authenticated and only the authorized persons will be able to access the information related to their respective projects.

Modules for logging network related complaints and viewing complaint status, have also been added to RRCAT Infonet. Changes were carried out on RRCAT Infonet server to incorporate connection pooling feature for connectivity to Oracle 10g database. This has resulted in increased number of concurrent users for the services provided by RRCATInfonet.

**F) Enhancements to RRCAT Website:**

RRCAT website has been enhanced with new look and feel. The web pages have been re-designed and re-arranged with updated contents. The look and feel has been changed using pull down menus and cascading style sheets. The contents for RRCAT Newsletters from the year 1988 to 2007 are provided in electronic form by conversion from paper copy. The contents of divisional pages have been re-arranged as per the changes in organizational structure.

**G) Deployment of APAC-07 Proceedings:**

Proceedings of APAC-07 (Asian Particle Accelerator Conference 07) were generated electronically and deployed on <http://jacow.org> website. Contributions to the conference were classified into different groups based on invited papers, contributed papers, and poster presentations. Proceedings of conference can be viewed based on Session, Classification, Author, Keyword or Institute. All the contributions are available in PDF format.

**H) Deployment of JAS-08 Website:**

A website for Joint Accelerator School 2008 has been developed and deployed on <http://jas08.cat.ernet.in>. This site contains information related to Programme schedule, Registration details, Committee details and Contents of the delivered talks, in PDF format.

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**I.2 Development in networking and communication at RRCAT****A) RRCATNet planning, expansion and upgradation:**

Under phase IV of network expansion, internal - CAT5E based - networking of few buildings namely, Laser R&D H - Block, Fire Station, AECS, TSH, and Old Production building was completed. In all, 200 nodes were added to RRCATNet. All the above mentioned buildings have been connected to the RRCATNet using DSLAM links and CAT6 cables. The commissioning of optical fiber backbones to various buildings under phase IV is underway and is expected to be completed in few months time.

**B) Enhancements to RRCAT Data Centre:**

The data centre at RRCAT, houses all the shared computing and IT resources of our centre. Due to addition of more number of such resource over the past few months, the electrical and AC facilities of the data centre had to be augmented. Necessary augmentation was carried out to support the requirements and thereby ensure smooth operations of the data centre.

User data on the email servers at our centre is increasing day by day, hence the backup related setup has to be constantly revamped. Backup of the various email server related log files and user data is currently being performed on network attached storage using the ethernet connectivity. The backup is performed using the tar and gzip utility over the network, with a full backup being performed on Sunday morning and incremental backups on other week days. Enhancements were made to the backup setup, for reducing the backup window from the previous duration of more than 24 hours to about 9 hours at present in full backup mode and to 2 hours in incremental mode. This has resulted in faster access of email services during working hours.

**C) Email and Internet access setup enhancements:**

Designing of a new email setup, utilizing fast and high capacity SAN based disk storage systems in cluster mode was completed and necessary hardware and software has been processed for procurement.

The current email setup at our centre was further enhanced to include facilities for forwarding of emails received in INBOX folder only, thereby excluding all unwanted DETECTED\_SPAM folder emails from being forwarded, thus increasing our usable internet bandwidth.

Various unified threat management products were evaluated for incorporation in our network, to provide clean virus free traffic flow from and into our network. The