CDAC
The Supercomputing People

ANNUAL REPORT

2004 ~ 2005

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

Governing Council

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(List of ex-GC Members)

Dr. Arun Shourie,
served as the Chairman, Governing Council, C-DAC,
till 25th May 2004

Shri K. K. Jaswal,
served as the Vice Chairman, Governing Council C-DAC,
till 31st October 2004

Shri S. Lakshminarayanan, IAS,
served as the Member, Governing Council C-DAC,
till 31st October 2004

Mrs. Aruna Sundararajan, IAS,
served as the Member, Governing Council C-DAC,
till 21st February 2005

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Overview

THIS YEAR HAS SHOWN C-DAC'S CONTINUOUS ENGAGEMENT IN CONSOLIDATION OF ITS COMPETENCIES AND SKILL SETS IN CHOSEN AREAS; BUILDING TECHNOLOGIES, TOOLS, PRODUCTS AND SOLUTIONS OF RELEVANCE TO THE NATIONAL CONTEXT; ORIENTATION TO MARKET NEEDS, USER EXPECTATIONS AND PROGRESSIVE L ARGE SCALE DEPLOYMENT THROUGH PARTNERSHIP; AND CONTINUATION OF SERVICE TO INDUSTRY THROUGH ITS FL AGSHIP TRAINING COURSES/PROGRAMMES.

The Centre for Development of Advanced Computing (C-DAC) is an autonomous scientific society of the Department of Information Technology (DIT), Ministry of Communications and Information Technology (MCIT), Government of India. It is primarily an R&D institution involved in the design, development and deployment of electronics and advanced Information Technology (IT) products and solutions. It is a multi-locational, multi-activity organization spread out at 10 locations with 14 laboratories and has a work force of about 2100 employees. The year 2004-05 was the second financial year of operations of C-DAC after the merger of (i) Electronics Research and Development Centre of India (ER&DCI), (ii) National Centre for Software Technology (NCST) and (iii) Mohali Centre of the Centre for Electronics Design & Technology of India (CEDTI) into C-DAC on December 16, 2002. The technologies that C-DAC has addressed during the year include, High Performance Computing (HPC) and Grid Computing, Multilingual Computing and Allied Areas, Power Electronics, Agri-electronics, Real Time Systems, Embedded Systems and VLSI Design, Information Security and Networking, Broadband, Wireless and Internet Technologies, Software (including OSS/Linux), Multimedia, Graphics and Database Technologies, Geomatics, Health Informatics, e-Governance and ICT for Addressing Digital Divide, and Education & Training.

The key achievements during the year in each of these areas are given in this report.

The highlights of the achievements are:

- Initiation of the Proof-of-Concept (PoC) Garuda Grid Project, which is intended to aggregate computing and data resources across several locations in the nation, to enable scientists, researchers and other users of high performance computing systems to make use of such resources with greater ease.
- Launch of several products and solutions in the area of multilingual computing and allied areas. These initiatives were aimed at proliferating the usage of multilingual technologies for IT for masses. During the year, C-DAC has also consolidated its language technology initiatives and programs and roll out release of free software tools and fonts in various languages scheduled in next financial year.
- In electronics and allied areas, the Underwater Range Complex at Goa and the Model Tea Factory (MTF) at Jorhat were setup, inaugurated and dedicated to the nation. Several other development initiatives were completed during the year.
- During the year, C-DAC took concrete steps to bring its software and hardware solutions into products for various sectors such as health, e-Learning, e-governance, security, etc. Several turnkey projects were also executed including those in the areas of geomatics, cyber security, scientific and engineering applications, broadband, wireless and Internet technologies.

In addition to technology development initiatives, this year has shown continuous improvements and C-DAC's engagement in human resource development by providing industry-specific as well as futuristic cutting-edge technologies through its branded training courses, seminars and workshops.

Technical Activities

WIDELY ACCLAIMED AND RECOGNIZED FOR ITS INDIGENOUSLY DEVELOPED PARAM SERIES OF SUPERCOMPUTERS, C-DAC HAS DIVERSIFIED ITS CAPABILITIES TOWARDS NEW AND EMERGING DOMAINS TO DEVELOP CUTTING EDGE PRODUCTS AND SOLUTIONS IN THE AREA OF ELECTRONICS AND INFORMATION TECHNOLOGY.

C-DAC's technical activities are broadly classified into the following areas

- **HIGH PERFORMANCE COMPUTING (HPC) AND GRID COMPUTING**
- **MULTILINGUAL COMPUTING AND ALLIED AREAS**
- **POWER ELECTRONICS, AGRI-ELECTRONICS, REAL TIME SYSTEMS, EMBEDDED SYSTEMS AND VLSI DESIGN**
- **INFORMATION SECURITY AND NETWORKING**
- **BROADBAND, WIRELESS AND INTERNET TECHNOLOGIES**
- **SOFTWARE (INCLUDING OSS/LINUX), MULTIMEDIA, GRAPHICS AND DATABASE TECHNOLOGIES**
- **GEOMATICS**
- **HEALTH INFORMATICS**
- **E-GOVERNANCE AND ICT FOR ADDRESSING DIGITAL DIVIDE**
- **EDUCATION AND TRAINING**

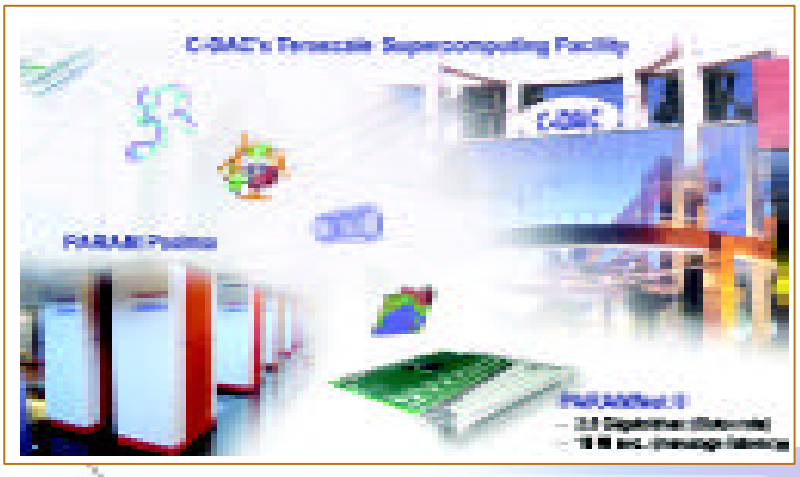
The scope of activities during the year for each of these is outlined below :

HIGH PERFORMANCE COMPUTING (HPC) AND GRID COMPUTING

After having built and commissioned the PARAM Padma system during the last financial year, there were focused efforts this year to increase its user base. As a result, the use of PARAM Padma steadily increased in terms of utilization time and during the year, served large number of researchers working in frontier areas and mission critical user groups in a variety of disciplines. Over 40 Technical Affiliate users from various disciplines and premier institutions actively used the system. New users were also encouraged to benefit from the system, in turn, leading to demand for more clusters of varying compute power in their own organizations or as a shareable facility. The value proposition for building a new system for National Centre for Medium Range Weather Forecasting (NCMRWF) by C-DAC, arose through such a demonstrated value of the system.

Some of the technical affiliates who were served by PARAM Padma during the year were:

- Indian Institute of Astrophysics, Bangalore
- JNCASR, Bangalore
- IIT, Mumbai
- Institute of Bioinformatics & Applied Biotechnology

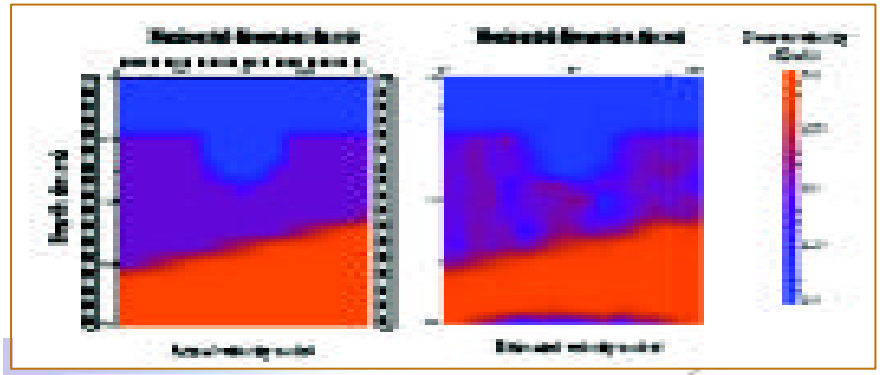


Supercomputing Facility

- IIT, Guwahati
- IISc, Bangalore
- IIT, Kanpur
- Space Applications Centre, Ahmedabad
- CDFD, Hyderabad
- IIIT, Hyderabad

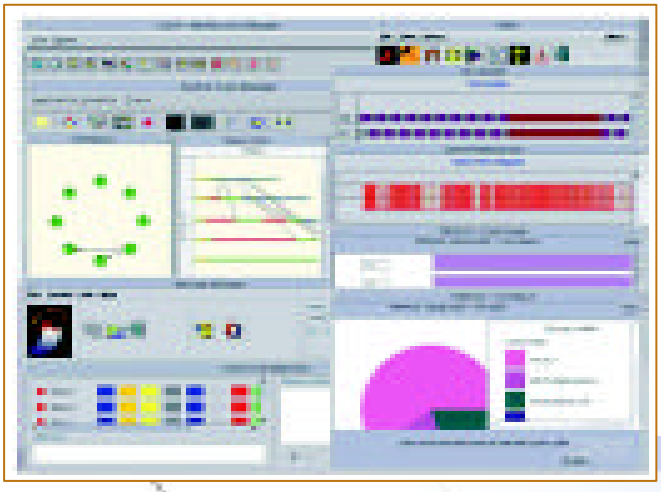
Other activities during the year in the area of HPC included commencement of PARAMNet III design (10 Gbps interconnect for clusters), Reconfigurable Computing Solutions (RCS) prototype testing for Raman Research Laboratory (RRL), upgrades in system software, and significant amount of work in HPC application areas such as Bioinformatics, Weather Forecasting, Computational Fluid Dynamics, Structural Mechanics and Evolutionary Computing.

A Bioinformatics Resources & Applications Facility (BRAF) was set up and inaugurated by the Secretary, DIT, MCIT at C-DAC's Terascale Supercomputing Facility (CTSF), Bangalore on June 14, 2004.



Seismic Tomography

The Seismic Traveltime Tomography software (SEISTOM) based on 2D finite difference traveltime calculations and real coded genetic algorithm has been developed and tested with a number of critical synthetic subsurface models.



DIViA

DIViA (Debugger with Integrated Visualizer and Analyser), a parallel program correctness and performance debugger, was enhanced to provide point-to-point communication matrix. The visualization interface was also improved to provide zoom-in and zoom-out features. DIViA stability and scalability testing were carried out.

The scalability testing of **C-MPI** up to 32 nodes was successfully completed. Applications such as MM5 were also successfully tested with C-MPI.

The HPCC software was successfully deployed at the National Metallurgical Lab (NML), Jamshedpur.

Garuda

The Grid computing project got approved for its Proof of Concept (PoC) implementation and efforts started towards its architecture, technology and standards definition. Work was commenced and rapid progress was made in all components of the project including research, technology development, standards, computational resources and grid enablement of applications. By its very nature, Grid computing being a collaborative effort, C-DAC received enthusiastic response to its efforts from a number of premier institutions. During the year, agreements were reached for significant collaborations with University of Hyderabad, Anna University, National Chemical Laboratory (NCL), Space Applications Centre (SAC), Ahmedabad and National Centre for Atmospheric Research (NCAR), USA.

MULTILINGUAL COMPUTING AND ALLIED AREAS

C-DAC had initiated a number of projects for the futuristic requirements of language computing. They include graffiti inputting in Indian languages, development of open type fonts in all the major Indian languages, Unicode based search engine, Java components, generic dictionary format development, localization tools and framework development, predictive writing in Indian languages, smart/expert writing system development, etc.

C-DAC also signed a MoU with the Tokyo University of Foreign Studies (TUFS), Japan and is collaborating with Bitstream, UK for Indian language fonts rendering engine technology. Major research has also been initiated in the area of Digital Video Broadcasting (DVB) to support Indian languages. Major focus areas include embedded systems, mobile

computing and text-to-speech systems. Enhancements in the existing language tools and product range have been carried out, including Nashir. C-DAC is also engaged in the COIL Net project funded by the TDIL. The focus has also shifted from sale of packaged products to customized solutions, such as enabling G-2-C applications, banking applications, e-governance applications, mobile devices and printers.

Tools for Visually Impaired

A Computer Aided Text-to-Speech and Text-to-Braille System (Shruti-Drishti) for Visually Impaired was launched. It integrates C-DAC's Extractor and Vachantar applications with the Webel's Text-to-Braille, emboss-printer, Braille script viewer and tactile reader to enable visually impaired persons to listen to the proceedings of Conference Websites.

C-DAC in collaboration with CSIO, Chandigarh is also doing a project aimed at designing and developing a hand-held scanner based Hindi and English text-reading machine for visually impaired.

Embedded Indian Language Solutions

Several initiatives were taken in this area. The development, embedding and integration of Indian language solution for Mobile handsets was done for Sony Ericsson and Samsung. The EPSON, Japan project, which involved giving 10 Indian language support for their dot matrix printer range, was successfully completed. The printer supports ISCII, PC-ISCII and EA-ISCII interface. It has total 40 built-in fonts, 4 fonts per script. C-DAC and Sun Microsystems released Solaris 9.0 with Indic support. The Indian language support was provided to Sun Microsystems by C-DAC in this development.

LILA

C-DAC's LILA (Learn Indian Language through Artificial Intelligence) PPP (Praveen, Prabodh, Pragya) SLA (South Indian Languages) package was launched by Hon'ble Minister of State for Home, Shri Manik Rao Gavil, in the presence of Hon'ble Minister for Home, Shri Shivraj Patil, on September 14, 2004. The package enables learning of Hindi through the means of South Indian Languages.

Machine Assisted Translation

MaTra is a human aided machine translation system from English to Hindi. Substantial enhancements in scope and accuracy were made during the year. Support for fragments, compounds and various tenses of verbs were completed. The pre-processing component was augmented to identify and handle abbreviations, symbols, date formats, and currency. The English-Hindi transliteration component using genetic algorithms was explored to transliterate unknown English words and named-entities.

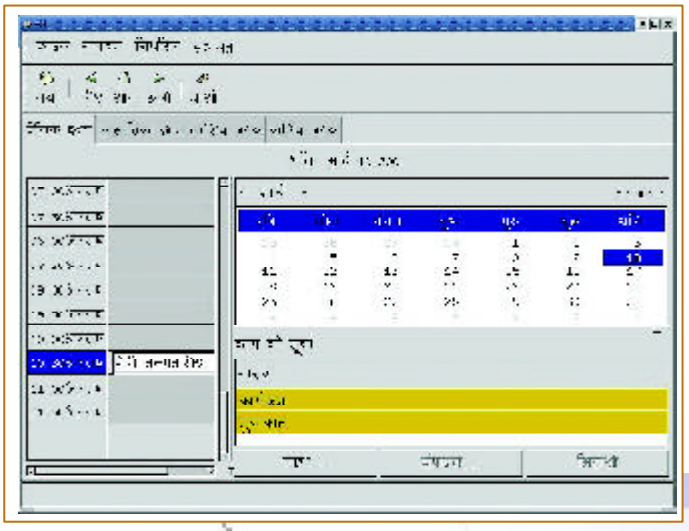
The design and development of a Machine Assisted Translation System for translating JAE question papers of Indian Institute of Bankers and Finance from English to Hindi was completed.

Machine translation of a simple English sentence to Bangla and Development of bi-lingual lexicon (English-Bangla) has been achieved.

Fonts

The development of highly compact and efficient Open Type Nastaliq font and its deployment on Deutche Welle, Germany news portal was completed.

Under the IndiX2 project, software and fonts have been developed to support twelve Indian languages that include Hindi, Marathi, Sanskrit, Kannada, Malayalam, Tamil, Gujarati, Telugu, Bengali, Assamese, Oriya, and Gurumukhi.



gnome - Calendar

As most of the Linux distributions are now based on FreeType2, they have been upgraded to FreeType 2 libraries from the earlier FreeType 1.4, which has allowed IndiX to be current with the times. The reordering of characters is based on the visual ordering of Unicode. The reordering is now traceable to a standard independent of lower level font technology like OpenType. The OpenType fonts have been designed to work with the visually reordered syllable without any feature flags. Thus the shaping pipeline and the fonts are simpler and robust. All the Jana series fonts have been revised by the IndiX development team to conform to the visual order. The new series has been called Saral.

The IndiX shaping library has been reorganized to be similar to the ICU library with the additional intermediate step of visually ordered syllable of characters. The shaping architecture has been changed from a script specific program driven form to a table driven one. All the script dependencies are encoded in the tables. The program is common across all scripts. Moreover, the shaping is only concerned with the changes that are required. It does not require parsing and analysis of the whole syllable. The incremental approach, where the focus is on the changes needed and executing them, is minimal and bases the shaping on its visual foundations. Attempts have been made to carry the Indic computing community along with these simpler and better approaches. Live bootable CDs for the 12 languages with all IndiX capability are now ready. Print tools have been inserted in the CD with all the above enhancements.

Multilingual Information Retrieval

Setu is a cross lingual information retrieval system for accessing English language material on the web for a Hindi-speaking user. An experimental version of the system using MaTra as the translation engine and Google as the search engine was made available. The parsing component has been enhanced. Support for Boolean operators and transliteration operators were added.

Speech Technology

For the development of Manner-based Lexically Driven Speech Recognition system for Indian languages, a study on word boundary recognition has been completed for Bangla continuous speech signal (accuracy of around 86%). Implementations of varieties of Feature Extraction methods (frequency domain and time domain) was completed. A study based on the above methods was completed for vowel recognition in Bangla.

A study on formulation of Intonation and Prosodic Rules in Bangla using the large Bangla Tagged Speech Corpus is currently in progress. C-DAC has proposed to develop raw and annotated corpora as well as corpora development tools for Indian languages such as Hindi, Indian English, Punjabi and Marathi. For this, the technique of Concatenate Speech Synthesis is being used.

Multilingual Digital Library

The objective of this initiative is to digitize rare books, manuscripts, magazines and other documents for making them available in soft copy form. As the data in physical form is being digitized, the tools and utilities required for its optimal use are also being developed. This would help in managing, searching and maintaining the digitized information easily. More than 17643 books comprising of about 7.2 million pages have been digitized so far. Tools such as “Cross Lingual Information Retrieval” are being developed to enable the digitized information available in one language to be made accessible in multiple languages. Tools are also being made available to enable digitized information to be retrieved in the form of image or text and to be searched in different ways.

Digital Library

POWER ELECTRONICS, AGRI-ELECTRONICS, REAL TIME SYSTEMS, EMBEDDED SYSTEMS AND VLSI DESIGN

Power Electronics, as a vital part of industrial control, is a major thrust area for C-DAC. The advancement in Real time high speed Digital Controllers and Power Semiconductor devices have enabled this technology to play a key role in the areas of power quality improvement, electric traction, pollution free vehicles, automotive electronics, non-conventional energy sources, remote controlled vehicles, energy efficient power supplies and drives, etc.

C-DAC has taken keen interest in updating its knowledge base in frontier technologies and innovations to meet the technological revolution and new challenges in the area. In close coordination with premier academic institutes in the country, our development activities are targeted towards realizing the mission to make India a global player in Power Electronics Technology.

The products/solutions delivered during the year in this area include the following:

- The Underwater Range (UWR) Complex set up by C-DAC was dedicated to the nation by Dr. V. K. Aatre, Scientific Adviser to the Defence Minister in a function held at the Naval & Science Technological Laboratory, Range Technology Centre (NSTL/ RTC), Goa on June 9, 2004. The complex, consisting of two magnetic and a shallow water noise range, is an important health-monitoring facility for naval ships to enhance their combat-worthiness. This is the first over-run range in this part of Asia. The data handling system and electronics in the offshore part were developed and installed by C-DAC.

Underwater Range (UWR) Complex

- For the characterization of Tea leaf in CTC machine output, Gray Level Concurrence Matrix (GLCM) texture analysis and wavelet-based analysis have been implemented to characterize the tea leaves. Colour analysis algorithms giving an estimation of the Cutting Quality of the leaves coming out on the conveyer belt from the CTC roller have been implemented.
- Development of a Remote Inspection Device (RID) was completed. This development was sponsored by Babha Atomic Research Centre (BARC). They have appreciated the effort and have now contacted C-DAC for the development of a larger version of RID to handle “glassified” waste.
- A Trouble Call Registration and Management System was commissioned at the Kerala State Electricity Board (KSEB) control room, in Kochi. With this system in place, consumers can register their fault reports and can get their registration docket numbers via SMS. The system also uses GSM technology for dispatching the fault jobs to the mobile maintenance staff deployed at various places.

- The Model Tea Factory (MTF) at Toklai, Jorhat, Assam was inaugurated by the Hon'ble Chief Minister of Assam, Shri Tarun Gogoi, on September 25, 2004. The MTF has been constructed under "Integrated Automation of Tea Processing" project funded by DIT, MCIT, DoC, MoCI and CSIR and implemented by C-DAC, Kolkata, CEERI, Pilani and TRA.

Model Tea Factory at Toklai, Jorhat, Assam

- The CompactPCI Industrial Computer developed by C-DAC's Real Time Systems Group (RTSG) at Bangalore was launched on July 2, 2004. The development was an initiative of the Industrial Applications Division (IAD) of the DIT, MCIT.
- A power supply module for Mirage Aircrafts was developed. It has passed all types of approval tests, and is now ready for flight trials in the fighter aircraft.

Development of Power Consumption Monitoring System

The system consists of Embedded Web Server with Ethernet interface at the five locations viz. Power and Blowing Station (PBS), Power Plant II (PPII), Main Step Down Station I (MSDS I), MSDS II and MSDS III.

The Embedded server is the Process Control Unit (PCU) developed at C-DAC. It is used for collecting the electrical parameters from the various areas in Bhilai Steel Plant.

Distribution Automation System for Thiruvananthapuram city- Phase II

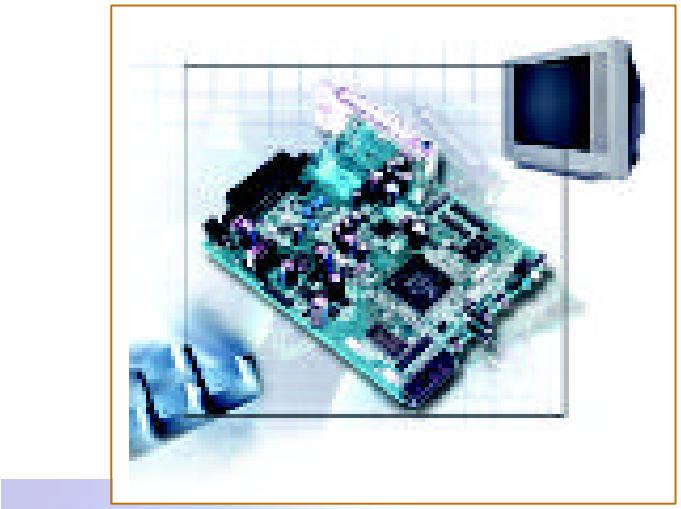
Distribution Automation Project for Thiruvananthapuram city was a project taken up as part of the Retrofit Automation Projects of Department of Information Technology, Ministry of Communication and Information Technology (MCIT) under its Technology Mission Programme of using Information Technology in improving management of distribution of electricity in India. The project was jointly implemented by C-DAC, Thiruvananthapuram and Kerala State Electricity Board (KSEB) and funded by the DIT and KSEB.

Black Box for Automobiles

A project for the Design and Development of Black-Box for Automobiles was started in April 2004. The prototype has been developed and is being Pilot tested.

Design and Development of Direct to Home Set Top Box (STB)

This was an in-house post project development to test and promote the DTH technology developed. Around 50 sets of DTH boxes were made and installed for field-testing at various locations. The feedback received was encouraging. Required modifications in the embedded software as per the feedback have been implemented. The technology has been optimized to match the Indian Manufacturing Industries requirements. The technology has already been transferred to ECIL, Hyderabad for mass production. Further activities in the area of STB undertaken and presently on-going are development of browser based, open standard interoperable Open Source Set Top Box, and STB for Internet Access on TV. C-DAC is engaged in a project to evolve technology standards so as to provide Set Top Box designs, which are interoperable, either based on simulcrypt CAS or using CI model.



DTH Set Top Box

Development of Electronic Nose for Tea

Sponsored by the National Tea Foundation, an electronic nose model, capable of classifying and estimating quality of food and agro products, has been developed. Initial experimentations with black tea have yielded encouraging results in terms of aroma and flavour characterization and indexing. A co-relation has been established with Tea Tasters' scores also for direct acceptability by various categories of Tea Enterprises.

Real Time Web Portal

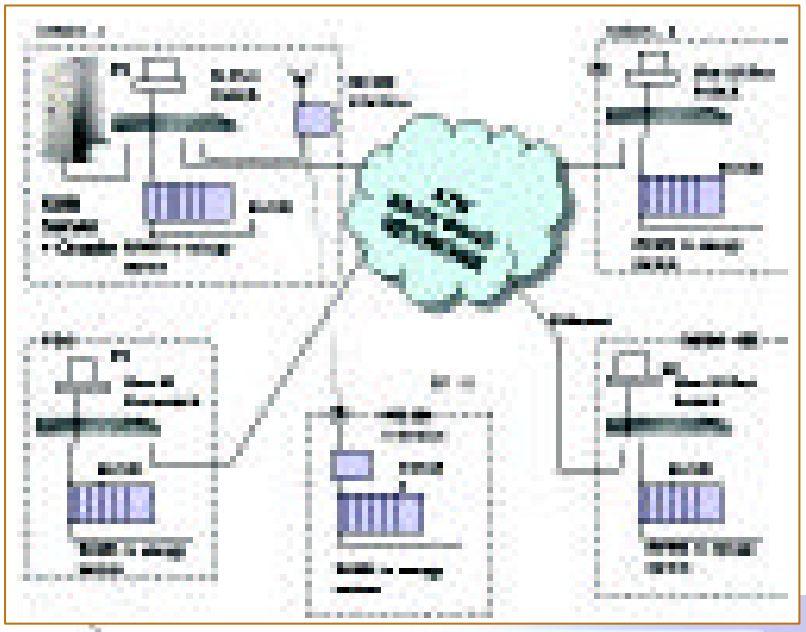
A web portal was developed for the Haryana State Load Dispatch Centre (HVPNL), Panipat to host the real time power data of the state. The system has been installed, tested and commissioned successfully at the customer site. The data is hosted on the web at the URL www.haryanasldc.org.

Design and Development of Monitoring System for Rourkela Steel Plant (RSP)

The design and development of a monitoring system for the first ever-successful power wheeling Rourkela Steel Plant (RSP) from Durgapur, involving satellite communication between RSP to SLCC, Kolkata was undertaken.

ATM based plant-wide Networking for Bhilai Steel Plant (BSP)

The project envisages state-of-the-art ATM communication technology over Fibre Optic Backbone for integrating the information islands in BSP. This will improve the productivity as well as the product quality in the plant besides guiding the management in taking effective control decisions.



Process Control Unit (PCU)

RT-Linux Device Drivers for On-board Computer

The Real Time Systems Group of C-DAC, Bangalore jointly with the Hyderabad centre completed the development of RT-Linux OS device drivers for the onboard computer project of the DRDO.

CompactPCI Industrial Computer

CompactPCI Industrial Computer was designed and developed by the Real Time Systems Group (RTSG), C-DAC. This project was an initiative of the Industrial Applications Division (IAD) of the DIT, MCIT, Government of India. The product was launched on July 2, 2004, during a workshop on “CompactPCI Solutions for Industrial Control”, held at IISc., Bangalore.

CompactPCI Industrial Computer

INFORMATION SECURITY AND NETWORKING

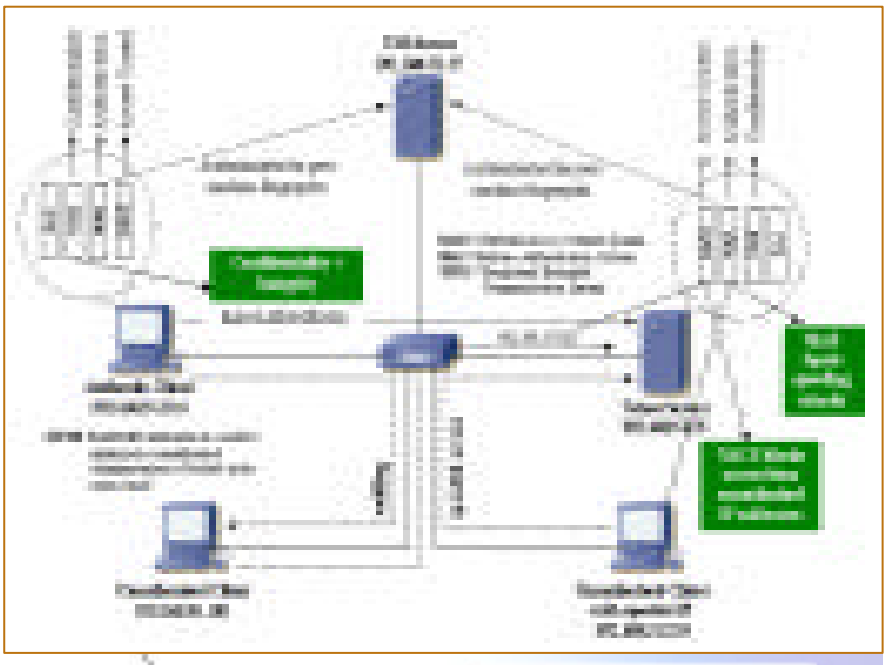
With the increasing attacks on networks and systems on the Internet and Intranets, information security has become of paramount importance to all types of organizations. Realising this, C-DAC has focused on developing cyber security solutions at different levels through its R&D centres. Some of these activities carried out during this financial year are covered below:

Technical Resource Centre for Cyber Forensics (TRCCF)

A Technical Resource Centre for Cyber Forensics was setup at C-DAC, Thiruvananthapuram for pursuing the cyber forensics activities. The indigenous development of cyber forensics tools included the development of (a) True Back - Disk imaging tool. (b) Cyber Check - Data recovery and analysis tool. (c) Email Tracer - Software for tracing the sender of an email. (d) Hasher - Data authentication tool and (e) DataRec - Data recovery tool. These developed tools have been made available to law enforcement agencies throughout the country for combating cyber crime. These tools have been distributed among law enforcing agencies of the country to enable them to follow-up the implementation of the IT Act 2000, specially with respect to cyber crimes. They have been successfully used in the investigation and analysis of the sensational pornographic blackmail (threatening e-mail) of Kidangor Engineering College.

Transparent Security Solution for End Systems

An R&D project titled “Design and Development of a Transparent Solution for Securing Networks and Systems” was funded by Department of Information Technology, Government of India. Under the project, an end system security solution was implemented for both Windows and Linux environments. This project was completed on January 31, 2005. An R&D project in continuation to the earlier project, which involves development of transparent security solution for UDP based applications, began in January 2005.



Transparent Security Solution

Design and Development of Integrated Security Device for Tracking and Data Acquisition

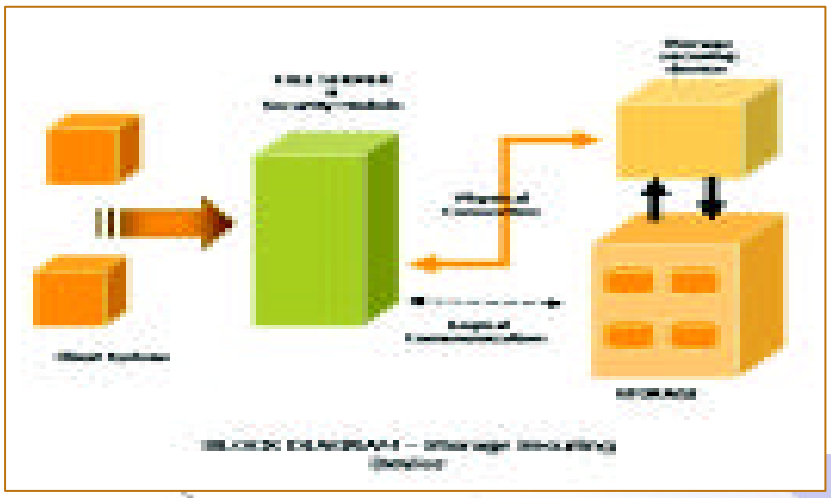
C-DAC commenced work on the development of a RFID based high-end Reader system that incorporates GPS and GSM features. In the designing of the “Integrated security device for tracking and data acquisition” the focus is on a general RFID system that reads passive tags and is integrated with GPS and GSM modules suited for many applications e.g. ammunition vehicle tracking system, attendance management system in schools and colleges, object tracking in supply chain management, car parking management system, and so on.

Development of Print Document Security Toolkit

The project was to develop a low cost solution for security of printed documents and provide the same on the user’s desktop without any special printing equipment or special paper. It provides document security by putting text data with special pattern in the background that is almost invisible to the naked eye, but if the document is photocopied, then a special text e.g. photocopy or duplicate will be visible on the photocopied document. The data to be hidden is dynamically generated by the software based on user input. The product has been integrated with MS-Word for ease of operation and usability. The project has been successfully completed and the technology is available in a product form on a CD-ROM called **C-DAC-Shield.**

Development of Storage Securing Device with Intrusion Detection

The major objective of the project is to prevent undetectable tampering and/or modification/ deletion of stored data in a storage device. The storage solution aims primarily to provide point in time data recovery using techniques like comprehensive versioning. Comprehensive versioning is a technique that can be utilized to create version for every change of time. These techniques are in line with “Continuous Data Protection” paradigm, which aims towards “Zero-Data-Loss”. Under a project sponsored by the DIT, a prototype of such a technique on qmail (Mail Server) has been developed. The software comprehensive versioning module has been placed with the qmail server. A closed user group of about 10 users has been made to use the mail server.



Storage Securing Device

The user(s) can recover files from the mail server even after permanent deletion of the file. The approach is along the lines of "ILM Best Practices in data recovery for Email " provided by the Storage Network Industry Association (SNIA).

National Resource Centre on Steganography

C-DAC, Kolkata developed Steganalysis software, which was successfully integrated with the Packet Sniffer software developed by IIT, Kanpur.

Stego-Check v 1.0 has been developed to cater to the analysis of stego images and the developed software has been integrated with the CyberCheck Software Suite. Filters have been designed to analyse different multimedia objects like audio and text for detecting the existence of innocuously embedded text message.

Smart card based computerization of accounts for small business enterprises for handheld devices

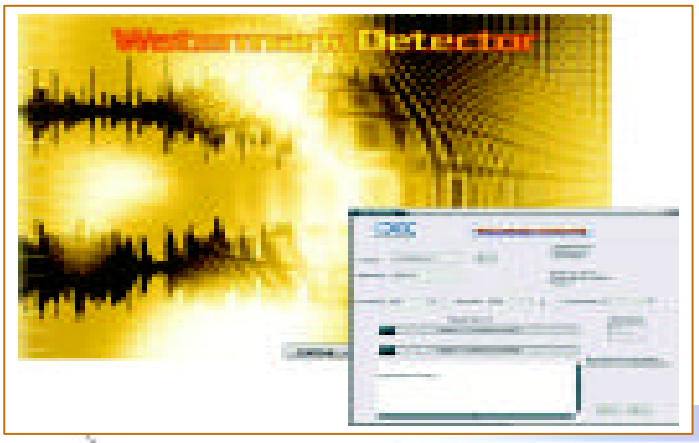
A computerized General Ledger Accounting System for Small Business Enterprises has been developed with secured transmission of business data over POTS between hand-held intelligent client terminal and the Application Server at the Application Service Provider (ASP) facilities by introducing Encryption Type Smart Card, PKI technology and strong encoding techniques.

Development of a software based system for face identification

The major objectives of this recently initiated project is to develop Face Recognition software for identification and verification of human face from frontal view. The software will cater to the national need of different law enforcement agencies, forensic laboratories and the National Crime Record Bureau.

Watermarking Digital Audio and Setting up of a Resource Centre for Digital Rights Management System

C-DAC developed a Watermarking Digital Audio Tool, an efficient solution for protecting intellectual property rights of the valuable assets of music industries. The tool constitutes a complementary pair of software applications called Watermark Embedder and Watermark Detector.



Watermarking Digital Audio Tool

Lawful Interception of VoIP Traffic (LIVoIP)

The LIVoIP system consists of two functional components. The Law Enforcement Interception Facility (LEIF), which is deployed at the premises of ISP and the Law Enforcement Monitoring Facility (LEMF), which is deployed at the premises of the Law Enforcement Agency (LEA). Transfer of data from LEIF to LEMF is through a data network. The system will run on a real time operating system and it supports on-line interception and monitoring of VoIP calls.

Attack Methodology Analysis, Network Attack Modelling and Survivability Simulation

The main aim of this project was to provide an extensive investigation into advanced attack analysis methods and theory.

N@G - Network at Guard

N@G is a Hybrid Intrusion Detection System (IDS) having capabilities of both misuse and anomaly detection. Current version of N@G includes, the N@G-MS (N@G Management Server) and the N@G-NS (N@G Network sensor).

N@G - Network at Guard

BROADBAND, WIRELESS AND INTERNET TECHNOLOGIES

The explosive growth of wireless systems using technologies such as Wi-Fi, Wi-Max, Bluetooth and Software Defined Radio is seen during the last few years. C-DAC has been working on some of the interesting systems using Broadband, Wireless and Internet technologies.

The most important achievement of C-DAC in this area has been the development and commercialization of the entire protocol suite including base-band and terminal equipment

TETRA (TErrestrial Trunked RAdio)

complying to EU (European Union) standard for professional Radio (TETRA). During the year, this technology was exported to United Kingdom (UK) and China. It is also being used by BEL (Bharat Electronics Limited).

TETRA Hand-held Radio

TETRA Hand held mobile radio is a single module design to meet the compact size and weight requirement. Mechanical package and aesthetic design of products have been a major support activity of this group. Physical package design for products like IP Telephone, Bluetooth modules/dongles and TETRA Handheld Radio has been done using 3D design packages. Conceptualisation, 3D modelling, assembling and verification are done prior to rapid prototyping of the products, with due consideration for aesthetics and ergonomic aspects. This in-house capability was instrumental in faster product realization and is being adopted by other groups of C-DAC for better realization of products.

C-DAC also designed and developed a broadband Software Defined Radio (SDR) equipment for customer premises to provide rural connectivity. The system is based on OFDM (Orthogonal Frequency Division Multiplexing) architecture and consists of Base band, RF and IF modules. The system has been designed based on Conexant Chipset and uses wireless LAN 802.11g architecture. Device drivers and interfaces have also been developed to integrate various devices. The system will be manufactured by M/s. ITI Limited and will be utilized initially by M/s. IFFCO for distribution of fertilizers through their retail outlets.

C-DAC, Noida has implemented a project on “Design and Development of OFDMA based Broadband Access System for Rural Communication” with the support of the Department of Science and Technology (DST) and the Telecom Regulatory Authority of India (TRAI). The project involved development of broadband wireless, OFDMA Software Defined Base Station (SDBS) and Software Defined Mobile Radio (SDMR) at customer premises. The end users connectivity at the rural end would be provided through SDMR, which would access to base station through wireless (fast Ethernet). The network would be used for Internet application, VOIP and LAN interconnectivity between the various SDMR and the outside world through the SDBS. M/s ITI, Bangalore is the partner for productionisation.

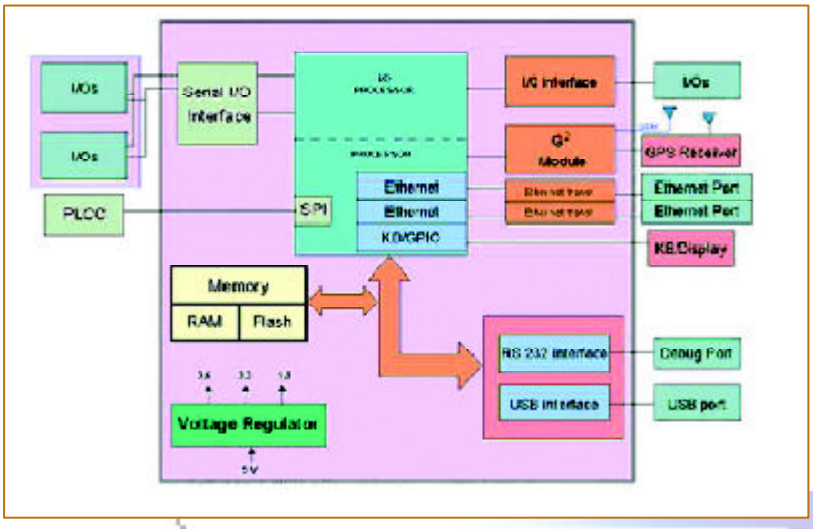
OFDMA based Broadband Wireless Band Access for Rural Connectivity

The e-Governance Group of C-DAC, Thiruvananthapuram has successfully completed the Acceptance Testing of Wireless Network connecting 291 Akshaya centres, 45 Police

stations and 25 Government offices, as part of the Akshaya project in Malappuram district. Akshaya is a project of the Government of Kerala for addressing the digital divide and to impart e-literacy for at least one member each of the 65 lakh families in Kerala. Akshaya received the Silver Icon Award during the Eight National Conference on e-Governance held during February 3-5, 2005 at Bhubaneshwar.

Design, Development and Field demonstration of Mobile Remote Terminal Units (MRTU)

The project aims at the design and development of a compact MRTU with Real Time Operating System. Major hardware features include GSM and GPS interface, USB support, Ethernet port and so on, built around a powerful processor. Software development is being done on an evaluation board based on ARM core.



Functional Block Diagram of MRTU

Compact TETRA Base Station Transceiver [Compact BS]

C-DAC has developed core technologies for TETRA mobile communication systems. These include technology for multi-carrier base station (BS), for hand-held (HH) portable radio and for vehicular mobile station (MS).

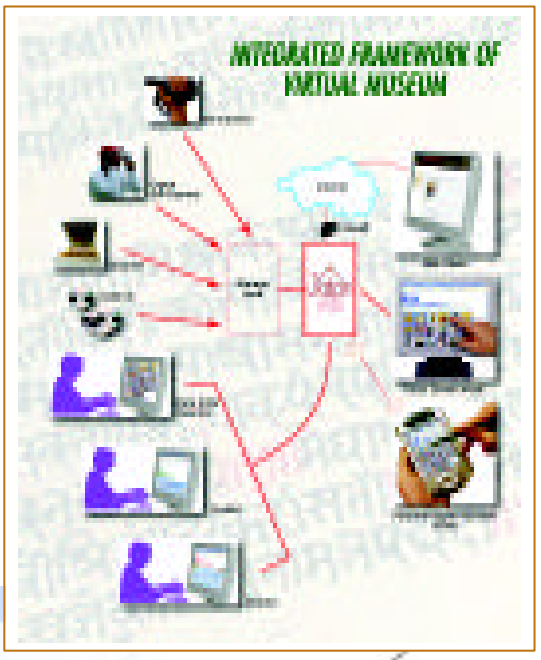
The current project aims at developing a portable and field deployable Base Station, which can be set up and brought into operation within minutes, to cater to fast disaster management.

SOFTWARE (INCLUDING OSS/LINUX), MULTIMEDIA, GRAPHICS AND DATABASE TECHNOLOGIES

Building on existing expertise on Linux and other open source systems and projects such as Indix and Vidyakash, activities have been initiated to develop technical expertise and human resources in this area. A portal for open source software was developed. Specific proposals are being taken up to fund this effort from DIT and other sources including relevant industry. In this direction, C-DAC, Mumbai, IBM, India and IIT, Mumbai signed an agreement on October 6, 2004 to set up a “Open Source Software Resource Centre (OSSRC)” at Mumbai. Enough groundwork has also been done to establish a Free and Open Source Software (FOSS) centre at C-DAC, Chennai.

JATAN: Virtual Museum Builder

C-DAC's National Multimedia Resource Centre, Pune designed and developed a specialized digital library system for museums named 'JATAN:Virtual Museum Builder'. JATAN was successfully deployed at the Prince of Wales Museum, Mumbai and Raja Kelkar Museum, Pune. This technology has been developed as part of the Digital Library Technology for Indian Heritage project, sponsored by Department of Information Technology, Govt. of India. The development of 'JATAN' has taken 3 years of interdisciplinary explorations and efforts.



JATAN

Release of CD's on the Life and Work of Srinivasa Ramanujan

A set of two CDs on the 'Life and Work of Srinivasa Ramanujan' designed and developed by C-DAC's National Multimedia Research Centre (NMRC) and the Institute of Mathematical Sciences (IMSc), Chennai was released on the occasion of the 117th Birth Anniversary of Ramanujan. The CDs were presented to His Excellency Dr. A. P. J. Abdul Kalam, President of India on December 24, 2004 at Rashtrapati Bhavan, New Delhi. The project was sponsored by the Department of Science and Technology (DST), Government of India.

CD ROM on Life & Work of Srinivasa Ramanujan presented to His Excellency Dr. A. P. J. Abdul Kalam, President of India

3D Computer Game Development for Teaching Watershed Management Technique

This 3D Game Development project has been jointly undertaken by the Watershed Organization Trust (WOTR), Ahmednagar, the National Multimedia Resource Centre, C-DAC, Pune and the Graphic and CAD Division, C-DAC, Mumbai. Simulation of terrain with realistic rendering, designing the game-play, interface for navigation through 3D terrain, visual interface metaphors and interaction through touch screen kiosk are the biggest challenges of this project, as the targeted users will be illiterate villagers. Several interface prototypes have been designed and field tests are being conducted to find out the cognitive abilities and visual literacy of the villagers. The proposed game is currently in the process of development.

Watershed Organization Trust (WOTR)

Janabhaaratii

In October 2004, C-DAC announced the launch of its "Janabharatii" project focusing efforts on developing a software suite based on Linux for Indian languages. The broad objective of this project is to enable the wide use of Indian language computing through Free/Open Source systems and applications localized in Indian languages.

Currently, the Maharashtra Police headquarters, Municipal Administration Office, Worli, SNDT University Library Science Department's post-graduate course "Content Development in Indian Languages" are using the janabhaaratii suite.

GEOMATICS

Based on the core competency available in this area, C-DAC executed several projects during the year. The major ones are:

- Identification of hilly zones within Pune Municipal Corporation (PMC) limits using high-resolution satellite imagery. The project gains in significance from the urban encroachment in the 'tekdi' (hilly region) areas of Pune city, which has drawn sharp criticism from environment conscious citizens and has also led to a major movement by NGO's to save the hills.

- In association with the Snow and Avalanche Study Establishment (SASE), C-DAC has implemented near real time snow cover monitoring, change detection and

avalanche information using GIS and remote sensing. The project work involved identification, classification and monitoring of different snow classes and registered/ non-registered avalanche sites using multi-temporal optical and microwave remote sensing data over the Northern Himalayas. Advanced image-processing techniques including sigma naught, ortho-correction and texture analysis were attempted to demarcate the snow line and extract snow characteristics in mountainous regions of India.

Web- based GIS application

- A GPS Less Locating System (gLS) has been developed to provide information on the location of vehicles within an area and its movement on real time. The system consists of Vehicle Mounted Unit (VMU), Base Station Unit (BSU) with a computer and necessary application software. Each vehicle carries the VMU, which interfaces to the GSM (Global System for Mobile communication). The VMU reports the position of the vehicle to the Base Station via a GSM network. This allows the base station computer to monitor the vehicles.

- A Decision Support System was configured to manage the formulation and flow of information within the district and from the district to the state. This activity required the integration of data from various departments within the district, analyzing the data and proposal of plan. The system provides the IT framework for information handling, leading to planning activities in respect of Education, Health, Roads, Irrigation, Power and so on. The system is GIS based.

HEALTH INFORMATICS

In this area, C-DAC has created software suites for Hospital Information System (HIS) and Telemedicine. During the year, efforts were made towards their features enhancement and their larger deployment. New development projects, like AyuSoft, were also initiated. The activities are described below.

Development of Telemedicine Technology

The 'Development of Telemedicine Technology' project was granted an extension with enhanced scope. Implementation work was taken up to upgrade the existing sites at the All India Institute of Medical Sciences (AIIMS), New Delhi, Sanjay Gandhi Post Graduate

Institute of Medical Sciences (SGPGIMS), Lucknow, and Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh.

As the enhanced scope required a satellite site to be set-up with each of the super-specialty sites, three new sites were raised at Medical Colleges at Shimla, Cuttack and Rohtak. The new linkages built are SGPGIMS and S.C.H Medical College (Cuttack), PGIMER and Indira Gandhi Government Medical College (Shimla), and AIIMS and Rohtak Medical College (Rohtak).

Under the project, C-DAC has deployed its indigenously developed integrated telemedicine solution - Mercury™ and Sanjeevani.

Setting up of Telemedicine and Tele-education Facilities in Kerala

This project is being jointly implemented by C-DAC and the Indian Institute of Information Technology and Management, Kerala (IIITM-K). The objective of the project is to set-up identified Tele-Health Services in the State of Kerala viz, Tele-Consultation and also Tele-Education tuned for Continuing Medical Education (CME) in the state.

The telemedicine technology solution, Mercury™, to be used in the project, has been developed by C-DAC .

Setting up of Telemedicine facilities in two States in North East India

The project is being jointly implemented by C-DAC and Apollo Telemedicine Networking Foundation (ATNF). The objective of the project is to set-up Tele-Consultation Services in the two states of Sikkim and Mizoram in North East India.

The Namchi Government Hospital, Sikkim is functional and is connected to the super-specialty Apollo Hospital at Delhi. A similar set-up will be executed at Mizoram.

The Telemedicine Centre in Sikkim is equipped with Clinical Equipment like ECG machine, Ultrasound machine (Color Doppler), Digital Microscope and Camera, Electronic Stethoscope, Pulmonary Function Test machine, HP Monitor, Glucometer and so on. C-DAC has deployed its Telemedicine technology solution, Mercury™ here.

Application of Image Processing Techniques for Improved Feature Extraction in Echocardiography Related to Cardiac Diseases

Development of an Image Processing Software Package for enhancement, calculation of ejection fraction from automatic identification of LV boundary, proper identification of tumour, haematoma and fibroid for echocardiography image has been completed.

A Memorandum of Understanding (MoU) has been signed between M/s. L&T Ltd. and C-DAC, Kolkata to integrate the developed software package with the future versions of echocardiography machines to be manufactured by M/s. L&T Ltd.

Design and Development of CORDIC Based Array Processors for Implementation of a PC Based Colour Doppler Ultrasonography System

CORDIC based array processors

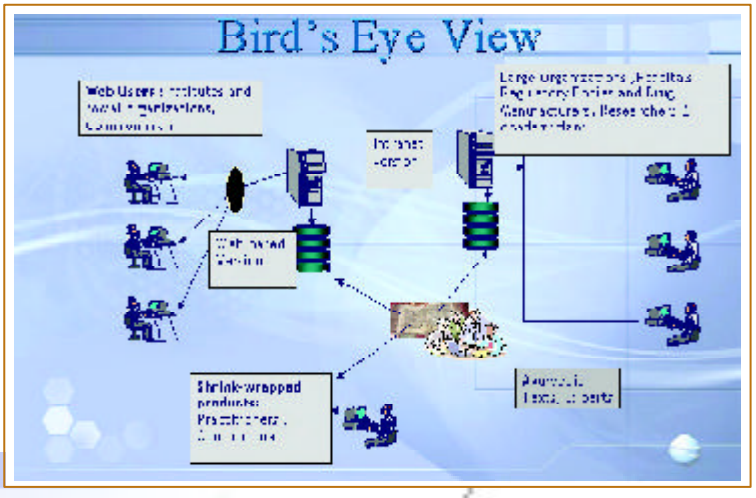
An Image processing software has been developed for better clinical feature extraction in Ultrasonography images. The software has been handed over to IIT, Kharagpur for FPGA implementation.

Ayusoft

Ayusoft, a Decision Support System for Ayurveda, aims at developing an authentic, interactive and intelligent software system to assist medical practitioners and researchers to apply the basic principles of Ayurveda to the fullest possible level in their clinical practice and research activities.

Conceptualisation and strategy planning, study of existing products, compilation of Sutras from Charak, Sushrut, Asthang Hridaya, and Madhav Nidana, requirement elicitation, analysis, data collection, System Requirement Specifications and design of the system were undertaken.

The collaborators in this project are the Interdisciplinary School of Health Sciences, Dept. of Ayurveda, University of Pune, Janaprabodini, Pune, and Mind Technology, Mumbai.



Bird's Eye view of Ayusoft

Hospital Management System

C-DAC continued to develop, customize and deploy the integrated Hospital Management Information System (HMIS), during the year 2004-2005. The deployment of HMIS at the General Hospital, Sector – 16, Chandigarh and Mahatma Gandhi Institute of Medical Sciences (MGIMS), Sevagram is in progress. The Department of IT also awarded a project for the development and implementation of an Advanced Hospital Management System (AHMS) at the Regional Institute of Medical Sciences (RIMS), Imphal.

Cancer Care for Rural Masses

C-DAC, Thiruvananthapuram commissioned a project titled "Cancer Care for Rural Masses" at the Regional Cancer Centre (RCC), Thiruvananthapuram and four of its Early Cancer Detection Centres (ECDC) at Kannur, Palakkad, Kozhencherry, and Kochi. The system comprises of a Web based Hospital Information system at RCC, Out patient Management module at seven clinics, Medical Records Room and the Railway concession Counter at the Centre. Video conferencing between the centre and the Nodes has been facilitated over VSAT links. The centre was inaugurated by Hon'ble Chief Minister of Kerala, Shri Oommen Chandy on the 28th of October 2004.

Inauguration of the Kannur Cancer Detection Centre by Shri Oommen Chandy , Hon'ble Chief Minister of Kerala

E-GOVERNANCE AND ICT FOR ADDRESSING DIGITAL DIVIDE

e-Governance

C-DAC has taken far-reaching initiatives in the domain of e-Governance to deploy e-solutions, which promise improved transparency, speedy information dissemination, higher administrative efficiency and improved public services. As in other areas, our thrust in e-Governance is also a combination of participation with government and industry efforts in development of architecture, standards, technology, processes and the development and deployment of practices, projects and skill sets using state-of-the-art technology. We participate in central, state and local e-Governance initiatives, projects and programmes.

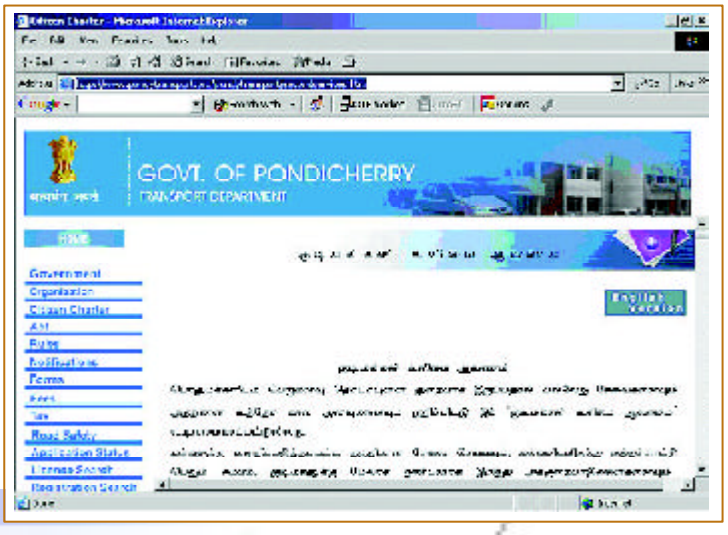
C-DAC's e-Governance solutions in the Pradhanmantri Grama Sadak Yojana (PMGSY), Public Works Department (Maharashtra and Tripura), Stamp and Registration (Maharashtra and Karnataka), Municipal Corporation (Karnataka) to name a few, are touching the lives of thousands of Indians across the country.

During the year, C-DAC worked with state governments in Karnataka, Kerala, Delhi, West Bengal, Uttar Pradesh, Himachal Pradesh, Orissa, Tripura, Goa, Pondicherry as also the Election Commission, the Railways, the Ministry for Rural Development and other agencies. On June 14, 2004, C-DAC received the CSI-Nihilent e-Governance Award for the "Best Technical Company in e-Governance".

Some of the key e-Governance initiatives during the year are listed below.

Workflow Automation

Workflow automation to move towards a paperless office for the Department of Technical Education and College Education and for Geographical Indication Registry (GIR), a Patent office arm, has been completed and implemented.



e-Governance Portal for Govt. of Pondichery

Portals for the Government of Pondichery were designed and developed for the Department of Commercial Taxes, Transport, Revenue and Civil Supplies. These are based on Open Source Software (OSS) environment and provide multilingual support.

Universal Banking Project - State Bank of India (SBI)

A solution for generating reports in Hindi through BankMaster software was provided to the SBI. The solution enables generation of 200 types of formatted reports relating to the Bank's internal working and correspondence with clients, in DOS environment. 9000 branches of SBI and its associate banks are expected to use the solution.

Enabling Core Banking Software - State Bank of India (SBI)

C-DAC has collaborated with TCS to enable the FNS software for implementing the core banking application at the domestic branches of the SBI in Hindi. A successful pilot project was carried out at the Churchgate Branch, Mumbai to test the solution.

Enabling Integrated Establishment Services (IES) in Hindi for the Reserve Bank of India

IES is an enterprise level web based application developed by CMC for the personnel department of the Reserve Bank of India. C-DAC provided a software solution for enabling the IES application in Hindi. The solution was implemented in over 13 regional offices of the Reserve Bank of India.

Electricity Bills Generation in Marathi - MSEB

Software solution for generating electricity bills in Marathi was provided to the Maharashtra State Electricity Board (MSEB). The solution is being used at 400 billing stations of MSEB spread all across the Maharashtra state.

File Tracking System in Gujarati- Government of Gujarat

A software solution was implemented with the File Tracking System of the General Administration Department of the Government of Gujarat. The solution will be used by 25 departments of the Government of Gujarat.

CM Online - Gujarat, Jharkhand and Andhra Pradesh

Portals for the interaction of the common man with the Chief Ministers of Gujarat and Jharkhand were designed in Gujarati and Hindi respectively. The application involves online filing of a complaint and tracking.

Television New channels - NDTV, CNBC Television 18, Star Plus

C-DAC's software solution is being used by news channels like NDTV, CNBC Television 18 for content creation in Indian languages, displaying it on video applications and the Web. Customized display fonts were developed to suit their requirements.

e-Form

e-Form provides an intuitive interface for quick data collection with minimum effort by understanding the user's need and data nature. This tool provides a mechanism to generate reports that help in the meaningful analysis of collected information. Though it has evolved from a healthcare project, as a tool, **e-Form** is very generic and its use is not limited to any specific domain.

The e-Form application is currently deployed at the Kutch Nav Nirman Abhiyan office in Bhuj and the application is accessible to all the Setu centres.

ICT for Addressing Digital Divide

Towards the use of ICT for digital divide, C-DAC's Bangalore centre in the Electronics City campus, together with IIT, Mumbai have partnered with the Digital Gateway Foundation (DGF), a United States-based non-profit institution, in which the Government of India is a member, to develop meaningful technologies in ICT for addressing digital divide. As part of this initiative, C-DAC has developed several interesting tools. These are as follows:

BharateeyaOO.o

The BharateeyaOO.o project began with the aim of taking OpenOffice.org to India in Indian languages. The objective was to enable Indian language support in all applications of the OpenOffice.org suite on Windows and Linux platforms. The scope is now extended beyond OpenOffice.org to 'Indianising' popular productivity tools like email, chat and browser.

Some of the languages supported so far are Devanagiri (Hindi, Konkani, Marathi and Sanskrit), Gujarati, Gurmukhi (Punjabi), Kannada, Malayalam, Oriya, Tamil, Telugu and Bengali

Matrubhasha

Matrubhasha is a Unicode and MBROLA™ based Software solution for Text-to-Speech Synthesis (TTS) and CMU Sphinx based Speech Recogniser for Indian languages. Matrubhasha was visualized with the objective of building a framework, which can be used by any software developer to incorporate speech capabilities (in Indian languages) into her/his software, thus increasing its usability across different sections of society.

ECKO

ECKO is a framework for building and nurturing E-communities. It provides a platform for creating, using, and sharing information among and across the members of E-Communities. This system is currently deployed at the Dhan Foundation, Melur in Tamil Nadu, UNDP in Orissa, AFARM in Maharashtra and MSSRF in Pondichery.

V-CAN

V-CAN, a P2P framework, built over JXTA's reference implementation, establishes a distributed network of community information systems in the intent of providing information dissemination with the help of supportive services such as content sharing, searching, replication, peer discovery and statistical profiling.

Vyapar

Vyapar provides a common on-line meeting ground for villagers where they can trade and post information about their goods, products and services. The system has been completely developed using free software. Currently, the system is in use in Melur, near

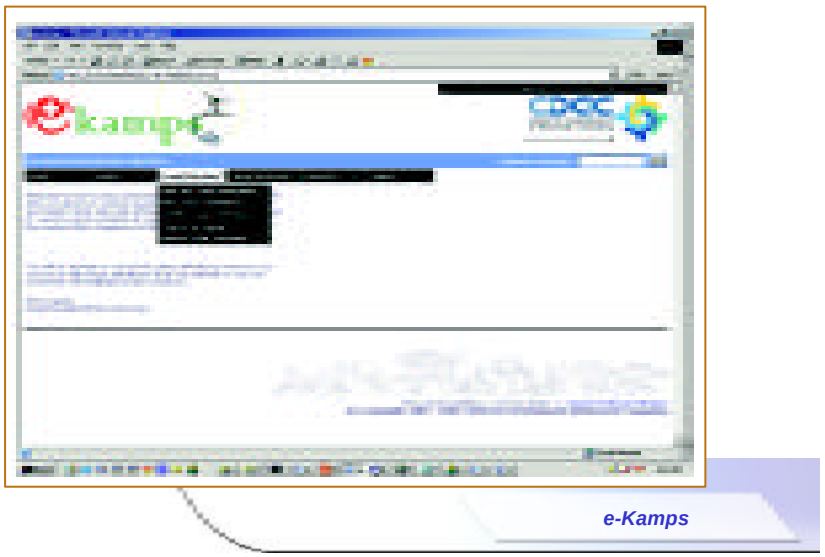
Madurai, in Tamil Nadu, National Informatics Centre, West Godavari Collectorate, Andhra Pradesh, Kutch Nav Nirman Abhiyan at Bhuj and MSSRF at Pondichery.

Multilingual Virtual Classroom (Vartalaap)

Vartalaap aims to develop a solution that will cater to the communication needs of people in their local language. Vartalaap includes two core components namely MCC (Multilingual Communication Channel) and VC (Virtual Classroom).

e-Kamps

e-Kamps is a web-based application to assist healthcare authorities. A notable tool that the e-Kamps application provides is a user friendly form designing tool, using which, a healthcare staff (the camp designer) can design their own need based forms (details collected are different for different diseases) for collecting data during the course of the camp conduction, using any handheld device like a simputer/PDA or using a usual desktop.



e-Kamps

Document Access Across Languages (DAAL)

Document Access Across Languages (DAAL) is essential for bridging the language divide. Setu is one such system based on DAAL. Setu enables a person to query and retrieve documents on the Internet in Hindi. This system is built on existing search engines.

Aid Management Platform (AMP)

AMP is a web-based application to track the delivery and reporting of aid for better planning and service delivery for both donors and recipient national governments. The pilot country for the AMP prototype is the Ministry of Finance and Economic Development (MOFED), Government of Ethiopia. The first release of AMP incorporating the Aid Information Module and Reports module has been completed. It has been successfully installed and pilot tested in MOFED, Ethiopia.

India Development Gateway (InDG) Portal

The implementation phase of the India Development Gateway (InDG) was formally inaugurated by Prof M S Swaminathan, Chairman, InDG and Founder, M S Swaminathan Research Foundation (MSSRF) at the DIT, New Delhi. The India Development Gateway (InDG), DIT, MCIT is a joint initiative of the World Bank, the Government of India and the Development Gateway Foundation (DGF), Washington, D.C. nucleated by the World Bank and other stakeholders. C-DAC is the implementing agency for the project.

Inauguration of InDG Portal

EDUCATION AND TRAINING

C-DAC, having created vast reservoir of experience in different fields of electronics and IT, set to itself a mission to share this experience for education and knowledge enrichment in the field of electronics and IT. Towards this every centre of C-DAC has been organizing a number of training programmes in cutting edge technologies such as VLSI, embedded systems and state-of-art computing.

During the year, C-DAC continued to offer its various certificate, diploma and post-graduate diploma courses in hardware and software technologies. Some key areas are Advanced Computing, Enterprise System Management, Geomatics, VLSI Design, Embedded Systems Design, Multimedia, Computer Aided Design (CAD), Software Technologies, and so on.

New education programmes namely M. Tech (IT) and M. Tech (VLSI Design) were launched during the year by C-DAC, Noida. C-DAC, Mohali conducted specially designed training programmes for international participants covering Advanced Course on Multimedia and Web Designing Technology, Repair and Maintenance of Telecom Equipment, Computers and Peripherals, Repair and Maintenance of Bio-Medical Equipment. More than 50 students from more than 20 countries participated in these training programmes. The Ministry of External Affairs, Government of India under the Indian Technical & Economic Cooperation (ITEC) and Special Commonwealth African Assistance Programme (SCAAP) sponsored the activity.

C-DAC also continued several specialized and customized national level corporate training programmes for the Indian Airforce, Central Soil and Material Research Station, Ministry of Agriculture, etc. Annual Competency test in Software Technology (CST) examination conducted by C-DAC, Mumbai for its Post Graduate Diploma in Software Technology,

Common Entrance Test (CET) conducted by ACTS, Pune for DAC, DACA, VLSI courses and the CET for DESD by C-DAC, Hyderabad found increasing response from the participants.

Corporate/Sponsored Training Programmes

C-DAC offered various specialized training programmes for the corporate and organized sector. C-DAC is working with the Indian Army since 1999 and has signed a MoU for offering IT training programmes to the Indian Army personnel. Similar training initiatives were also carried out for the Indian Navy.

C-DAC conducted a special Professional Education (PE) course on 'Introduction to RDBMS' for a Nigerian team from Ahmadu Bello University, Zaria, Nigeria. Short term courses on 'Introduction to Compiler Construction' for the Centre for Reliability (CFR), Chennai and on OOAD and UML were conducted for Roamware (India) Pvt. Ltd. C-DAC also conducted courses in workshops on 'Applications on Linux for the Industry' and on 'IT Infrastructure Management' for the Industry organised by Bombay Chamber of Commerce and Industry (BCCI). Other similar programmes included courses on Instruction Design and Assessment Technologies.

C-DAC also conducted training programmes for foreign nationals under the Indian Technical and Economic Cooperation (ITEC) and Special Commonwealth African Assistance Programme (SCAAP) scheme of the Ministry of External Affairs, Govt. of India.

C-DAC, Mohali is also one of the main Nodal Agencies approved by the Ministry of Heavy Industries and Public Enterprises to implement the Counselling, Retraining, and Redeployment (CRR) Scheme.

Some of the regular programmes offered at various training centres of C-DAC:

S.No.	Training Programme
1.	Advanced Diploma in CADD Engineering
2.	Post Graduate Diploma in Animation and Multimedia
3.	Advanced Post Graduate Diploma in Industrial Automation and System Design
4.	Application and Programming of PLC's and Drives
5.	Advanced Diploma in Bio Medical Equipment Tech and Maintenance Engineering
6.	Advanced Diploma in Enterprise Networking
7.	Advanced Diploma in Industrial Automation and System Design
8.	Diploma in Advanced Computing (DAC)
9.	Diploma in Information Technology (DIT)
10.	Advanced Diploma in Information Technology (ADIT)
11.	Diploma in VLSI Design (VLSI)
12.	Diploma in Geo-Informatics
13.	Diploma in Embedded Systems
14.	Diploma in Advanced Computer Arts (DACA)
15.	Post Graduate Diploma in Multimedia (PGDM)
16.	Advanced Course in Bioinformatics

e-Learning

As part of its endeavor to make education reach anywhere, anytime through e-Learning, C-DAC created a Centre of Excellence in e-Learning at Mumbai. Hyderabad, Pune and Kolkata centres are also contributing in e-Learning through content development, tools development, and offering of courses in e-Learning.

Parikshak

Parikshak is an automated program grading system. A new version of Parikshak was released. The major enhancement includes a provision to allow users to submit their code for evaluation against a chosen subset of inputs. New commands are added to get student code and to generate MGPT report. Enhancement and standardisation of command interfaces, bug fixes, and improved documentation are the other changes.

VedaSystem

Veda, the online testing and question banking system, has two versions at present. The old version will be retained till the new version is complete and stable. The following functionality has been added to the old Veda system;

- Post Test Evaluation of Question**:** This feature allows teachers to re-evaluate questions due to ambiguity/incorrectness in the question, which is found during post-test analysis of the questions. The system allows re-evaluation, dropping such questions or revising the answer, ignoring the previous answer or addition of new answer(s).
- Feedback on quizzes attempted by students**:** The feature allows teachers to generate feedback for student(s) in HTML format after a quiz. The feedback consists of questions attempted by the student along with the student's answer and correct answer.

The following functionality has been completed in the new Veda:

- Account Management**:** This feature allows managing of three types of users of the system: teacher, student and Veda administrator.
- User Group Management**:** The feature allows managing groups containing teacher account. This will enable sharing of questions among group members and creation of a quiz by multiple group members comprising of questions from their respective domain of expertise.
- Session Management: The basic requirement for managing sessions of various users using the system at any moment.

e-Sikshak

C-DAC, Hyderabad developed content for "Cyber Security Course" for network system administrators to be offered in e-Learning mode. The content consists of running text in PDF format, powerpoint presentation with speaker notes and voiceover, flash animations to explain important concepts and video lectures delivered by experts. As part of this, the team also put considerable effort in making the content SCORM compliant.

C-DAC has developed an in-house, customizable Learning Management System (LMS) and content has been developed for web deployment in many hi-tech professional areas. The development of C-DAC's **e-learning framework** is completed and made available in the form of a product **e-Sikshak**. In addition to the language support in English, Hindi and Telugu, another language Tamil has been added. The Indian Law Institute (ILI) is using e-Sikshak for offering their course on Intellectual Property Rights (IPR).

Consultancy Services

C-DAC HAS BEEN RECOGNIZED BY THE INDUSTRY FOR ITS INHERENT TECHNOLOGICAL EXPERTISE, WITH ITS SERVICES SOUGHT IN SEVERAL KEY PROJECTS AND PRODUCT DEVELOPMENT ACTIVITIES, AND HIGHLY ACCLAIMED FOR ITS ENHANCED SERVICE DELIVERY STANDARDS.

CONSULTANCY SERVICES

C-DAC has been extending its expertise and services to various government, R&D, academia and industry agencies in a number of areas from time to time. Some such activities undertaken during the year include:

- Assistance in the formulation of Roadmap for IT Implementation in various departments of the Government of Delhi / NCT of Delhi
- Support to ONGC Ltd for setting up Linux Cluster Computing based SDP facilities and the setting up of virtual reality centers for seismic analysis
- Data Centre Certification services to the State Bank of India, Mumbai
- Enterprise Data Centre and Statewide Networks for Chattisgarh State Electricity Board, Raipur
- Consultancy for setting up of Data Centre for the State Government of Kerala
- Assistance for core banking implementation in the Kerala State Cooperative Bank
- Assistance to Tokyo Engineering Consultants of Japan in providing networking solutions
- Systems study and consultancy for the Command Headquarters of the Indian Army, involving business process reengineering across all the Command Headquarters of the Army
- Services to the Sainik Welfare Board for the purchase of Hardware, Software, Data Collation and for Application Software Development.
- Services towards requirement study, specification planning, evaluation of offers, expert opinion, software development, hardware procurement, inspection of IT related equipment, etc. to
  - Corporation Bank, Head Office, Mangalore
  - National Institute of Design, Ahmedabad
  - Aeronautical Development Agency (ADA), Bangalore
  - Pidilite Industries, Mumbai

Resources, Facilitation Services and Initiatives

THE QUEST FOR TECHNOLOGICAL SUPERIORITY HAS LED C-DAC ON A PATH OF INFRASTRUCTURE DEVELOPMENT AND KNOWLEDGE ACQUISITION, TOWARDS FURTHER CONSOLIDATING THE STRONG FOUNDATION THAT HAS BEEN BUILT OVER THE YEARS.

RESOURCES, FACILITATION SERVICES AND INITIATIVES

LIBRARY AND INFORMATION CENTRE

C-DAC has automated its libraries at Pune, Bangalore, Hyderabad, Mumbai, Thiruvananthapuram, Noida and Mohali.

The special facilities include a Web-enabled Newspaper Clipping Service (E-clippings) extended to all centres of C-DAC. A complete archive of this service with a search engine is available on the site. The libraries are equipped with an exhaustive collection of documents consisting of books, reports, videocassettes, current journals, back volumes of periodicals, standards, software and manuals on the thrust areas of Information Technology. The entire library database comprising of books, periodicals, reports, standards, software, videocassettes and the on-line services are made available through the Library software- Libsys.

The Library functions at C-DAC, Thiruvananthapuram have been automated with the in-house developed 'WebLibman' Web based Library Management System.

In terms of technical infrastructure, C-DAC has set up a Data Centre with 20 Terabyte storage space and 8mb Internet connectivity.

HUMAN RESOURCES DEVELOPMENT

During the financial year 2004-05, the Human Resources Development Team at C-DAC continued its endeavors to accomplish C-DAC's organizational vision and mission. The HRD team remained focused on the organizational requirements and fulfilled the mandate to provide a member friendly, transparent and conducive work environment for C-DACians.

In the post-merger scenario with the integration of various societies, C-DAC commanded a strong professional team of **2132** regular, contract and project members by the end of the year.

The year has also witnessed the attrition rate of human resources reduce to 18% as compared to previous year's attrition rate of 27%. C-DAC has been able to retain its core and senior staff due to its focus on research and development and projects at the cutting edge of technology.

During February 2005, a HR Meet was held at C-DAC, Mumbai to evolve uniform procedures and HRD processes. All HR incumbents from the various C-DAC centres participated and brainstormed on several HR issues.

In the year under review, C-DAC also conducted two induction programmes and around 110 new members benefited from the training and development initiative.

At the corporate level, the HRD team coordinated and interacted within C-DAC and contributed to the development of unified staff rules, memorandum of association, bye-laws and rules and regulations.

KNOWLEDGE MANAGEMENT AND QUALITY INITIATIVES

The Hardware Technologies Development Group (HTDG) has applied for two patents.

MAJOR CONFERENCES/SPECIAL EVENTS ORGANISED

- A 5-Day training programme on **e-Suraksha** (A practical approach in Network Security) was conducted during May 2004
- **"Trends in Embedded Systems and Mobile Computing"** during July 2004
- **Grid Computing Workshops** were conducted at Pune and Bangalore focusing on grid program development, execution of tools for Grid Environment: Compilers, debuggers, performance monitors, and application development. C-DAC members and faculty from the Department of Computer Science conducted Grid Computing Workshop at MIT, Anna University, and Chennai in August 2004.
- A workshop and training programme on **Computational Fluid Dynamics** was conducted at C-DAC, Pune during Aug 23-27, 2004
- National Workshop on the **"Role of R&D in Water sector"** during September 9-10, 2004 at NWA / C-DAC, Pune.
- A 5-Day training programme on **e-Suraksha** (A practical approach in Network Security) was conducted during September 2004
- As a part of IOSN project, a workshop was held during October 7-8, 2004 with the **"Guide to Localisation"**, as the backdrop
- A two-day workshop on **Information Communication Technologies** was organized during October 15-16, 2004.
- A seminar on **'Artificial Intelligence'** was organized jointly with CSI on December 15, 2004.
- C-DAC, Noida and the Department of Information Technology, Ministry of Communications & Information Technology, Govt. of India organized the **International Conference On Speech and Language Technology (ICSLT, 2004)** during November 17-19, 2004.
- C-DAC, Mumbai, along with IIIT, Hyderabad, organised the **Fifth International Conference on Knowledge Based Computer Systems (KBCS-2004)** at Hotel ITC Kakatiya Sheraton, Hyderabad during December 20-22, 2004

- A one-day seminar on **"De-mystifying E-learning"** was held at C-DAC, Navi Mumbai (Kharghar) campus on February 26, 2005.
- A Business Model Workshop on **e-learning** was organised at C-DAC, Navi Mumbai on March 24, 2005 as a part of the Vidyakash Project.
- A four-week training programme titled **"Planning, implementation and management of E-Governance Projects – Level 1"** was held for Dy. CIOs of Govt. of Punjab by C-DAC, Noida.
- The NPSF has conducted workshops and training programmes at IUCAA-Pune, NML-Jamshedpur and the University of Hyderabad to create awareness of the **Parallel Processing** technology among the user community of supercomputing systems in the nation.
- C-DAC, Chennai organized a 5-day workshop on **e-Governance** for officials of the **National Productivity Council.**

- A workshop on **"Ubiquitous and Grid Computing" (U-n-G C 2005)** was organized by C-DAC, Hyderabad jointly with University of Melbourne on 3d January 2005
- A 5-day training programme on **"AKSHARAMALA software suit"** was conducted by C-DAC, Thiruvananthapuram during 13-17, Dec, 2004
- A two day workshop on **"Hands-on with ARM"** was organized by C-DAC, Hyderabad during 13-14, Aug 2004
- A 5 day training programme on **"Cyber Forensics and Cyber Forensic tools"** was organized by C-DAC, Thiruvananthapuram
- A workshop on **"Information Security"** was organized by C-DAC, Mohali on 26th ,June 2004
- A two day programme on **"Secure your business through Information Security"** was conducted by C-DAC, Mohali
- A one week training programme on **"Geoinformatics"** was organized by C-DAC, Pune for officers of the Indian Forest Service during 21-26, June 2004
- A workshop on **"Pune Air Quality Modeling"** was held by C-DAC, Pune during 14-17, March 2005 Jointly with USEPA, USAEP, and NEERI
- A 5-day workshop on **"Enterprise Linux System Administration"** was organized by C-DAC, Pune during 9-13, August 2005
- A National workshop on **"Open Source Supply Chain Management solutions for Industries to enhance profitability"** was conducted by C-DAC, Hyderabad jointly with IIIT, Hyderabad on 27th Nov, 2005
- A workshop on **"Digital Library opportunities, Usefulness, Issues, and future insight for publishers and content provider"** was organized by C-DAC, Noida during June 2004

PARTICIPATION IN EXHIBITIONS

ELITEX 2004

C-DAC participated in the Electronics and Information Technology Exposition (ELITEX) '2004 organized by the DIT, MC&IT, Govt of India at the India Habitat Centre, New Delhi during April 26-27, 2004. Dr Arun Shourie, Hon'ble Minister for Disinvestment, and Communications and Information Technology inaugurated the event. C-DAC launched two new products, namely C-DAC's Virtual Private Network (C-VPN) and CDAC-GIST YogeshN-OpenType at the exposition. C-DAC also showcased its entire range of products and solutions like the Remotely Operated Mobile Platform, Land Management Application, e-Sikshak, Cybercheck Suite, TETRA Radio, Multilingual Corpora, INTEGRA software, Bioinformatics applications and so on at the exhibition.

Elitex

PARTICIPATION IN CONFERENCES

- CeBIT-2004, Hannover
- EuroIndia 2004 Conference, New Delhi
- 25th Internationalization and Unicode Conference, Washington DC, USA
- International Symposium on Snow Monitoring & Avalanches (ISSMA – 2004), Manali
- "Systems Biology Markup Language (SBML) Hackathon 2004", EMBL-EBI, Wellcome-Trust Genome Campus, Hinxton, Cambridge
- INFOSEC 2004 " Information Security – Challenging and Emerging Issues" , Indian Merchant's Chambers, Mumbai
- 10th PHOENICS User Conference, Melbourne
- "India-United States Conference on Space Science, Applications and Commerce - Strengthening and Expanding Cooperation", Bangalore
- 92nd Indian Science Congress (ISC) held at the Nirma University, Ahmedabad
- 7th International Conference on High Performance Computing and Grid in the Asia Pacific Region, Omiya Sonic City, Tokyo Area, Japan
- Oklahoma Supercomputing Symposium 2004, University of Oklahoma, USA (through videoconferencing)

- TECHSUMMIT-2004, New Delhi
- International Conference for High Performance Computing, Networking and Storage, Pittsburgh, USA
- ADCOM 2004 held at the Nirma University, Ahmedabad
- National conference on “IT for silk industry”, Mysore
- 3-day Asia Pacific Conference on Parallel and Distributed Computing Technologies (ObComAPC 2004), Tamil Nadu
- 18th International Conference on VLSI Design -VLSI 2005, Kolkata
- 6th International Petroleum Conference and Exhibition (PETROTECH-2005), New Delhi
- Communication and Information Technology (CIT) 2005, Ahmedabad
- CNIRD-2005 held at the Defence Laboratory, Jaipur
- e-Learning conference, Delhi
- Fifth International Conference on Knowledge Based Computer Systems (KBCS-2004), Hotel ITC Kakatiya Sheraton, Hyderabad
- LinuxAsia2005 conference, Delhi
- International Conference on Knowledge Management (ICIM 2005), Grand Hyatt, Mumbai
- Indian Conference in Vision Graphics and Image Processing (ICVGIP) ’04, Kolkata
- Interspeech 2004-ICSLP at Jeju, Korea
- ICLST-COCOSDA 2004, Delhi
- Tamil Nadu Internet Conference, Singapore
- WWW/Internet 2004, Madrid, Spain
- R&D Management Conference, CSIR, New Delhi
- ELELTECH-05, C-DAC Hyderabad
- International Conference on Computer Communication and Control Technologies, 2004, Austin (Texas), USA
- SERP’04, Las Vegas, USA
- ACM-SIGCHI-SI National Usability Conference Easy 2004, Bangalore, India.
- Seminar on User Centric Design organized by Indo European Systems Usability Partnership (IESUP) and CSI, Mumbai
- International Conference on Human Computer Interaction (I-HCI 2004) organized by IESUP and CSI, Bangalore, India
- International Conference on Digital Libraries (ICDL), New Delhi, India
- NACLIN 2004, India
- International Conference on Information Management (ICIM), Mumbai, India
- National Seminar on e-Learning and e-Learning Technologies ELTECH 2005, Hyderabad, India

- Map India 2005; Hotel Taj Palace, New Delhi
- The High Performance Computing and Application (HPCA 2004), Springer, China
- The International Conference on Reconfigurable Computing and FPGAs (Reconfig04), Mexican Society of Computer Science, SMCC; September 2004, Colima, Mexico
- 16th IEEE International conference on Microelectronics (ICM 2004), Institute of Electrial and Electronics Engineers, IEEE; Tunis, Tunisia
- International Conference on Knowledge Management 2005 (ICIM 2005) at Grand Hyat, Mumbai
- National Convention on Library and Information Networking-NACLIN 2004, University of Pune, Pune
- 50th All India Library Conference 2004 on the topic “Knowledge Organization in Digital Environment in Library (KODEL): Introspects and Prospects”, M.S. University, Vadodara.
- Int. Conf. On Advances in Structural Integrity (ICASI 2004), Bangalore, India
- Int. Conf. on Theoretical, Applied, Computational and Experimental Mechanics, IIT-Kharagpur
- Proc. of 3rd Specialty Conference on ‘Conceptual Approach To Structural Design’, Singapore
- Naval Research Board Workshop on “Research Trends in Practice and Theory of Information Technology”, Cochin
- UT-04, The International Symposium on Underwater Technology, Taipei, RoC
- High Performance Computing and Grid in Asia Pacific Region Seventh International Conference on HPCAsia’04
- The Indian Geophysical Union Conference
- 66th conference of EAGE-2004 held at Paris, France
- RCS International Conference in Mexico
- Fast Software Encryption 2005 in Paris, France

National Science Day

INTERNATIONAL COOPERATION

C-DAC participated in the Joint Committee Meeting of the Russian Indian Centre for Advanced Computing Research (RICACR) held at Moscow, Russia on September 29, 2004 followed by the Joint Council Meeting of the Integrated Long Term Programme of Cooperation (ILTP) in Science and Technology during September 30-October 2, 2004. An MOU was signed for joint development and supply of Padma-Ru supercomputer by C-DAC and RICACR.

C-DAC participated in the visit of a high-level delegation on Science, Technology and IT led by Hon'ble Minister for Communications and IT, Dr Arun Shourie in February 2004. Specific areas of joint research and collaboration with premier Bulgarian institutions were identified in High Performance Computing, Grid Computing and e-Security among other areas.

C-DAC established an ICT Centre at Laos PDR under Indo-Lao PDR Bilateral Cooperation Programme. It was inaugurated by Shri K Natwar Singh, Hon'ble Minister for External Affairs on November 28, 2004 at Laos.

C-DAC's activities at Kofi Annan Centre at Accra, Ghana set up in November 2003 were further strengthened with the project nearing completion for the setting up of five Community Information Centres (CICs) at various locations identified by the Government of Ghana with satellite connectivity through a VSAT link.

Two MoU's have been signed by C-DAC for setting up IT Centres in Tajikistan and Uzbekistan. A C-DAC team visited Tajikistan and Uzbekistan to finalize the premises for setting up the IT Centres and planning of other logistics. The procurement of software, hardware and other equipment has also been initiated.

Communication and Promotional Matters

TO ENSURE THE STEADY AND TRANSPARENT FLOW OF INFORMATION ACROSS THE ORGANIZATION, MEMBERS AND STAKEHOLDERS, C-DAC'S CORPORATE POLICY MAINTAINS A COMMUNICATION PROTOCOL THAT ASSIMILATES THE REACH OF ALL AVAILABLE COMMUNICATION MEDIA.

COMMUNICATION AND PROMOTIONAL MATTERS

C-DAC Connect

C-DAC Connect, the house magazine of C-DAC that seeks to extend a common platform for C-DAC's members and stakeholders to share and express views, knowledge and opinions, continued with its quarterly publication exploring a range of technical subjects, soft features, news and views.

C-DAC Connect

AWARDS

- CSI-Nihilent Award for the 'Best Technical Company in e-Governance' by CSI-Nihilent on June 14, 2004
- Maharashtra IT Award as a meritorious IT enterprise in the category **IT R&D** by the Government of Maharashtra on August 20, 2004.
- 6th IETE Corporate Award for Performance Excellence in Software–2004 by the Institution of Electronics and Telecommunication Engineers at the 47th Annual Technical Convention of the IETE held at Ahmedabad
- Shruti Drishti received the Golden Icon Award for Exemplary Implementation of e-Governance Initiatives for the year 2004 in the category of 'Trail Blazing Application of the Year' from the Department of Administrative Reforms and Public Grievances (DARPG), Ministry of Personnel, Public Grievances and Pensions, Govt of India at Bhubaneshwar on February 3, 2005.

Maharashtra IT Award

Shruti Drishti received the Golden Icon Award

- C-DAC's Corporate Communication Team bagged two awards in the Technical Communication Competitions 2004 organized by the India chapter of the Society for Technical Communication (STC) for its Geomatics Solutions Development Group (GSDG) Brochure in the Technical Art Competition – Informational Materials Design category and for its Shruti Drishti Brochure in the Technical Art Competition – Promotional Materials Design category.
- Silver Medal for Exemplary Leadership & ICT Achievement of the year – New Entrants at the 8th National Conference for C-DAC's KAVERI software in February 2005

DISTINGUISHED VISITORS

Mr Daniel T Ling, Corporate Vice-President, Microsoft Research and Dr P S Anandan, Senior Researcher and Group Manager, Microsoft

Dr Thongchai Yooyativong, Dean, School of Information Technology, Mae Fah Luang University and Assoc Prof Gp Capt Yuthana Trangarn, Director, Center for Information Technology Services, Mae Fah Luang University

Thiru. Dayanidhi Maran, Hon'ble Union Minister for Communications and IT, Government of India

Mr. Kapil Sibal, Hon'ble Minister of State for Science and Technology and Ocean Development

Mr. Kapil Sibal, Hon'ble Minister of State for Science and Technology and Ocean Development

Mr Brijesh Kumar, IAS, Secretary, DIT, MC&IT

Mr Tilak Viegas, Principal Administrator, DG (Research), European Commission

Mr F C Kohli, Chairman, Tata Consultancy Services (TCS)

Prof Ramesh Agarwal, Director, Aerospace Engineering Program, Washington University, St. Louis, U.S.A

Maj.Gen.A K Saini, Senamedal, Addl Director General, Military Operations (Information Warfare)

Prof. Anurag Shankar, Indiana University , USA

Prof. Abhijit Bose, University of Michigan, USA and Associate Director, Michigan Grid Research and Infrastructure Development (MGRID) project, USA

Dr. Paul Twomey, President and CEO, Internet Corporation for Assigned Names and Numbers (ICANN)

Dr. Philippe Martinieu, a Scientist Attaché, R&D and University Cooperation between India and France, Embassy of France, New Delhi

Mr. Isamu Nitta, Chairman, JIBCC & former Ambassador of Japan to Sri Lanka

Parliamentary Standing Committee on Information Technology, led by the honorable Chairman, Mr M M Pallam Raju and other honorable Members of the Parliament along with officials of the Parliament Secretariat

Mr M M Pallam Raju, Hon'ble Chairman, Parliamentary Standing Committee on IT and members of the Parliamentary Standing Committee at C-DAC, KP, Bangalore

Dr Stuart Brown, Department of Energy, USA and Senior Scientist, International Centre of Theoretical Physics (ICTP), Trieste, Italy

Dr. Sunil R Das, Fellow of IEEE and Professor, School of Information Technology and Engineering (SITE), University of Ottawa, Canada

Prof. Biswa Nath Datta, IEEE Fellow and Presidential Research Professor, Northern Illinois University, USA

Mr Francois Brown de Colstoun, Director, European and International Affairs, INRIA (The French National Institute for Research in Computer Science and Control), France

Mr Buell Duncan III, General Manager, Developer Relations, IBM and Ms Gina Poole, Vice President, Developer Marketing and Web Communities, IBM

Mr. John Michalakes, Senior Software Architect, Mesoscale And Microscale Meteorology Division, National Centre For Atmospheric Research (NCAR), USA

Prof. Mamoru Maekawa, of the Graduate School of Information Systems, University of Electro-Communications, Tokyo, Japan

OTHER ACHIEVEMENTS

Papers Published

1. Katre, Dinesh S - "Chasing the Cognitive roots of our rectangular mindset" in The Idea #7, CD Gazette of Electronic Arts, 2003-04
2. G. L. Ganga Prasad – "Content Management System for Communities – information systems for rural communities in i4d Magazine, June 2004
3. Sanjay P. Sood - "Telemedicine through Telehealth to eHealth" in Networking in Telemedicine; Institute of Nuclear Medicine and Allied Sciences, Defence Research and Development Organisation New Delhi, 13-17 September, 2004
4. Sanjay P. Sood - "Implementing Telemedicine Technology : Lessons from India" in World Hospitals and Health Services; International Hospital Federation, Paris, France; Volume 40, Number 3, 2004, pp 29-30
5. J. Modi, S. Nanavati, A. Phadke and P. Panigrahi - "Wavelet transforms: Applications to data analysis-I" in Resonance, Vol. 9, No.11, Nov. 2004; pp.l0-22
6. Subbarao, D.; Batra, Karuna; Bali, Manik; Mitra, Sugata - "Computer simulation of cylindrical laser beam self-focusing in a plasma" in Computer Physics Communications, ELSEVIER, Volume 164, Issue 1-3, 12/2004, p. 472-476.
7. J. Modi, S. Nanavati, A. Phadke and P. Panigrahi - "Wavelet transforms: Applications to data analysis-II" in Resonance, Vol. 9, No.12, Dec. 2004; pp.8-13
8. Sanjay P. Sood - "Telemedicine : A prognostic prescription for rural healthcare in India" Chapter of the book 'Governance Issues in Rural Health', published by - Institute of Rural Management Anand (IRMA), Gujarat, India; Dec. 2004
9. M. Sasikumar – "Genetic Algorithms: Darwin solves some AI problems" in OORJA – IIIM Journal of Management and IT; 3 (1) Jan. 2005
10. S. Nanavati and P. Panigrahi - "Wavelets: Applications to image compression-I" Resonance, Vol..10, No.2, Feb. 2005; pp.52-61
11. Yerneni, S., Phadke, S., Bhardwaj, D., Chakraborty, S., and Rastogi, R. - "Imaging subsurface geology with seismic migration on a computing cluster" in Current Science, vol. 88, no. 3, Feb. 10, 2005; p. 468-474
12. S Nanavati and P Panigrahi - "Wavelets: Applications to image compression-II" in Resonance, Vol.10, No.3, March 2005; pp.19-27
13. Yogindra Abhyankar, C-DAC, Pune, "Reconfigurable Computing System Initiatives at C-DAC", "International Conference on "Reconfigurable Computing & FPGAs (ReConFig04)" held in Colima , Mexico during September 20-24 , 2004
14. Yogindra Abhyankar, C-DAC,Pune, "Solving Fracture Mechanics Problems using Reconfigurable Computing", "International Conference on "Reconfigurable Computing & FPGAs (ReConFig04)" held in Colima , Mexico during September 20-24 , 2004
15. Ajit Joshi, C-DAC, Mumbai, "Unicode for Multilingual Software: An Indian Perspective". 25th Internationalization and Unicode Conference held in Washington DC, USA during March 31-April 2, 2004

16. David Selvakumar, and R. Pitchiah all, C-DAC, Bangalore, presented papers on ”Fault Tolerant CORBA” and “Real-time CORBA”, Asia-Pacific Conference on Parallel and Distributed Computing, OBCOMAPC 2004, Vellore Institute of Technology, Vellore, during December 2004.

17. A. B. Saha and N. Bhattacharyya, C-DAC, Kolkata, presented a technical paper during International Conference on O-CHA (Tea) Culture & Science held at Sizuoka, Japan during 4-6 November 2004.

18. Vimal Gracian, “Bluetooth - A wireless proposition for Industrial Equipments”, CNIRD-2005, the National Symposium on Compact Nuclear Instruments and Radiation Detectors held at the Defense Laboratory, Jaipur during March 2-4, 2005

19. R. Ravindra Kumar, “IP-Core Embedded Systems for Nuclear Instrumentation”, CNIRD-2005, the National Symposium on Compact Nuclear Instruments and Radiation Detectors held at the Defense Laboratory, Jaipur during March 2-4, 2005

Thiru Dayanidhi Maran, Hon'ble Minister of Communications and Information Technology, Govt of India is briefed on the PARAM 10000 at the National PARAM Supercomputing Facility (NPSF), C-DAC, Pune.

Mr Brijesh Kumar, IAS, Secretary, Department of Information Technology, Ministry of Communications and Information Technology, Govt of India reviews the language technology products at the GIST Lab of C-DAC Pune. Also seen in the picture (L to R) are Mr Mahesh Kulkarni, Group Coordinator, GIST, C-DAC, Pune, Dr Hemant Darbari, Programme Coordinator, AAI, C-DAC, Pune and Mr S Ramakrishnan, Director General, C-DAC, Pune