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REPORT

2003-2004

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

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*   **Shri Rajeeva Ratna Shah**, served as the Vice Chairman, Governing Council C-DAC till July 02, 2003.

**   **Shri Y. S. Bhave** served as a Member, Governing Council C-DAC till October 08, 2003.

*** **Shri R. K. Arora** served as a Member, Governing Council C-DAC till September 30, 2003.

The C-DAC Vision | Our Mission Statement | Our Core Values

THE C-DAC VISION TO EMERGE AS THE PREMIER R&D INSTITUTION FOR THE DESIGN, DEVELOPMENT AND DEPLOYMENT OF WORLD CLASS IT SOLUTIONS FOR ECONOMIC AND HUMAN ADVANCEMENT **MISSION STATEMENT** TO CARVE OUT A NICHE IN THE GLOBAL ARENA OF ADVANCED INFORMATION TECHNOLOGY AND ENHANCE OUR BRAND IMAGE. TO CONTINUE TO CREATE AND DEPLOY THE FINEST TALENT IN OUR QUEST FOR FURTHER EXPANDING THE FRONTIERS OF HIGH PERFORMANCE COMPUTING AND COMMUNICATION TECHNOLOGIES AND ITS APPLICATIONS. TO ACHIEVE RAPID AND EFFECTIVE SPREAD OF KNOWLEDGE BY OVERCOMING LANGUAGE BARRIERS USING NATURAL LANGUAGE ORIENTED COMPUTING AND MULTIMEDIA TECHNOLOGIES. TO SHARE OUR VAST RESERVOIR OF EXPERIENCE FOR EDUCATION AND KNOWLEDGE ENRICHMENT IN THE FIELD OF INFORMATION TECHNOLOGY. TO UTILIZE THE INTELLECTUAL PROPERTY THUS GENERATED, BRING BENEFITS OF INFORMATION TECHNOLOGY TO SOCIETY, BY CONVERTING IT INTO AN EXCITING BUSINESS OPPORTUNITY AND ESTABLISHING A SELF-SUSTAINING AND WEALTH CREATING OPERATION **OUR CORE VALUES** INNOVATION AND PURSUIT OF EXCELLENCE IN 'APPLICATIONS', 'RESEARCH' AND 'TECHNOLOGY' (ART). INTEGRITY, TRANSPARENCY AND OPENNESS IN ALL OUR ACTIONS. WORKING WITH AND THROUGH THE 'TEAMS' IS OUR WAY OF LIFE. DISTRIBUTED LEADERSHIP ACROSS THE ORGANIZATION AT VARIOUS LEVELS. STRIVE TO CONTINUOSLY IMPROVE OUR PROCESSES AND QUALITY. ADDRESS THE NEEDS OF THE SOCIETY THROUGH USER CENTRIC INITIATIVES.

CONTENTS

OVERVIEW

C-DAC IS MOBILIZING ITS RESOURCES BOTH IN TERMS OF INTELLECTUAL AND TECHNOLOGICAL CAPITAL, TO MEET THE DEMANDS OF THE NEW TECHNOLOGY DRIVEN SOCIETY. WHEREAS A NATION ON THE ROAD TO DEVELOPMENT IS JUDGED BY THE MERIT OF ITS INFRASTRUCTURE AND DEVELOPMENT, C-DAC IS PAVING THE WAY FOR INDIA TO ACHIEVE ITS POSITION OF A GLOBAL LEADER.

Overview

Centre for Development of Advanced Computing (C-DAC) represents a unique facet to the nation's policies and initiatives in Information Technology. As an institution for high end Research and Development (R&D), C-DAC has been at the forefront of the Information Technology (IT) revolution, constantly building capacities in emerging technologies, innovating and leveraging its expertise, caliber, skill sets to develop and deploy IT solutions for different sectors of the economy, as per the mandate of its parent, the Department of Information Technology, Ministry of Communications and Information Technology, Government of India and other stakeholders including funding agencies, collaborators, users and the market-place.

The decade and a half of core competence garnered through its R&D activities has enabled C-DAC to consolidate its brand equity as a leader for innovative Information Technology (IT) and electronic technologies, products and services. The technologies that C-DAC has addressed include High Performance Computing (HPC) including Scientific Modeling & Visualization; Multilingual Computing, Applied Artificial Intelligence and Speech Processing; Software including Open Source Software (Linux), Multimedia, Graphics and Database Technologies; Strategic and Power Electronics and Agrielectronics; Real Time Systems, Embedded Systems and VLSI Design; Health Informatics; Geomatics; Cyber Security; Digital / Broadband and Wireless Networks; e-Governance and ICT for Digital Divide; and Education and Training including e-Learning.

C-DAC, over the years, has diversified its activities, transferring the expertise it acquired and technologies it developed to industry, end-users and the market-place to further develop and deploy advanced Information Technology (IT) based solutions in key sectors of the economy like Science and Technology, Healthcare, Power, Steel, Defence, Telecom, Agriculture, Industrial Controls, Broadcasting, Education and e-Governance. These initiatives have played a major role in cataloging economic activity and enhancing efficiencies through the use of ICT products / solutions in these economic and societal sectors. Simultaneously, C-DAC has continued to add new feathers to its cap with the coming together of other R&D Labs, into several related areas of technology like power electronics, agrielectronics and wireless that hold great benefit to the nation and citizens.

THE DECADE AND A HALF OF CORE COMPETENCE GARNERED THROUGH ITS R&D ACTIVITIES HAS ENABLED C-DAC TO CONSOLIDATE ITS BRAND EQUITY AS A LEADER FOR INNOVATIVE INFORMATION TECHNOLOGY (IT) AND ELECTRONIC TECHNOLOGIES, PRODUCTS AND SERVICES.

Realizing the increasing demands of a technologically inclined society, as well as the projected needs in the future, C-DAC is mobilizing its resources both in terms of intellectual and technological capital. While building its capabilities in promising enabling technologies, C-DAC also has been demonstrating its capabilities to implement end-to-end solutions in various verticals of economic and social sectors.

TECHNICAL

ESTABLISHED PRIMARILY AS AN R & D INSTITUTION TO CONTRIBUTE TO THE NATION BUILDING AGENDA OF THE COUNTRY, C-DAC'S R&D ACTIVITIES SPAN A WIDE SPECTRUM OF DOMAINS INCLUDING HIGH PERFORMANCE COMPUTING (HPC), HARDWARE AND SOFTWARE TECHNOLOGIES, POWER ELECTRONICS, BROADBAND AND WIRELESS, STRATEGIC ELECTRONICS, CYBER FORENSICS, DEVELOPING SCIENTIFIC AND ENGINEERING APPLICATIONS, DEVELOPMENT OF INDIAN LANGUAGE TOOLS, COMPONENTS AND APPLICATIONS.

C-DAC's range of technical activities are broadly categorized as:

- 🔲 **RESEARCH & DEVELOPMENT**
- 🔲 **SPONSORED/CONTRACT PROJECTS**
- 🔲 **ADVANCED TECHNOLOGIES LEADING TO MARKET SOLUTIONS**
- 🔲 **EDUCATION &TRAINING**

# RESEARCH & DEVELOPMENT

HIGH PERFORMANCE COMPUTING (HPC)

C-DAC's **High Performance Computing (HPC)** activities during the year encompassed hardware technologies, system software and scientific and engineering applications.

C-DAC's PARAM Padma [p630s+PARAMNet-II+CMPI configuration] was listed in the TOP 500 List of Supercomputers published in June 2003 based on Linpack performance results. PARAM Padma was ranked 171 and later at 257 in November 2003.

The development of the next generation high performance System Area Network PARAMNet-III with speeds of 10 Gbps full duplex and supporting standard software interfaces including Direct Access Protocol Library (DAPL) is underway.

A new **Reconfigurable Computing System (RCS)** P**CI based** 64-bit, 66 MHz card with a 3 million gate logic array as compute engine for mapping algorithms and on board 256 MB SDRAM for storage has been designed.

IEEE-754 compliant double precision floating point hardware library units, matrix multiplication and factorization modules have been developed. Successful integration of the factorization module to a fractural mechanics code has been completed. This solution on RCS provided an encouraging speed-up of ~12 times compared to a non-RCS solution.
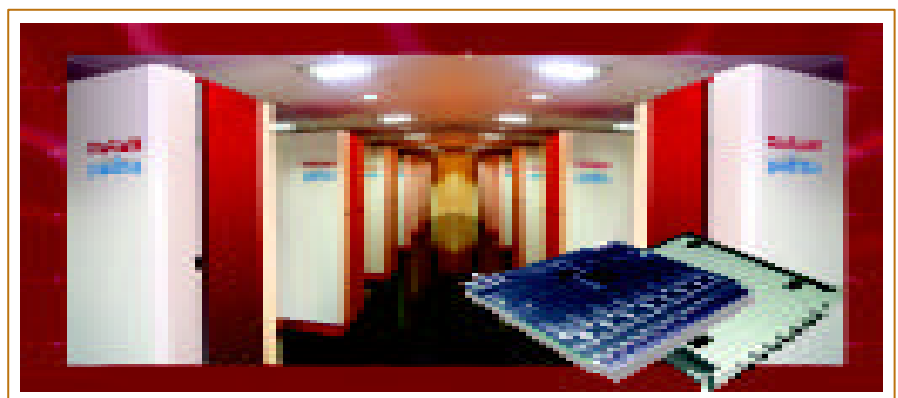
PARAM Padma

VARADA, a system software interface for the RCS Library (RCSL) has been developed for Red Hat Linux 9.0 and Windows 2000 operating system.


Varada

Kshipra

HPCC System Software for providing a flexible, parallel and distributed software environment was designed, developed and deployed on PARAM Padma with AIX operating system on the nodes. The environment including Cluster Management Software (CMS), integrated DIViA (Debugger with Integrated Visualizer and Analyser), PFS (Parallel File System), PCF90 (Parallelizing Compiler for Fortran 90) and JSAP (Job Submission and Accounting Package) were released on PARAM Padma. HPCC software was also released on Linux clusters with Intel nodes for the PARAM installation at Kofi Annan Centre of Excellence for Communications and IT, Accra in Ghana.

A prototype Grid was set up by interconnecting the National PARAM Supercomputing Facility (NPSF), Pune and C-DAC's Terascale Supercomputing Facility (CTSF), Bangalore through a 100 MBPS link and a bioinformatics portal was demonstrated over this Grid environment. The prototype environment was extended further by setting up a 100 MBPS link between CTSF at Bangalore and a Linux cluster in Hyderabad.

C-DAC's scientists have worked on an array of **diverse scientific and engineering applications.**
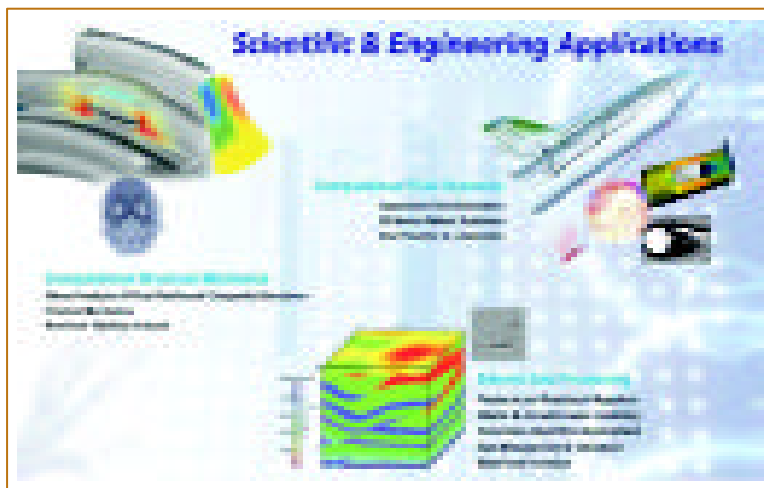
Scientific and engineering applications

C-DAC HAS BEEN CONTINUOUSLY STRIVING TO MEET THE NEEDS OF THE INDUSTRY AND THE NATION BY LEVERAGING ITS DIVERSE EXPERTISE INTO SEVERAL KEY DEVELOPMENT ACTIVITIES.

C-DAC's foray in the area of Supercomputing based **Bioinformatics** applications, has a manifesto to develop, port and optimize codes on parallel computers, in the areas of bioinformatics like molecular modeling, sequence analysis, comparative genomics and microarray data analysis.

A Problem Solving Environment (PSE) for molecular modelling codes like AMBER and CHARMM, and sequence analysis codes like Smith-Waterman, FASTA, BLAST and ClustalW have been developed for PARAM.

GRIDBLAST is an initiative to connect supercomputers, clusters, high-end workstations spread across the C-DAC campus to build a computing Grid for Bioinformatics applications. BLAST was the first application to be Grid enabled in the prototype. This grid prototype was based on a concept of synchronized web services model, using XML RPC libraries.

Protein folding Molecular Dynamics (MD) simulation was also undertaken, using the AMBER program on PARAM Padma. The folding simulation was carried out beyond 95 nanoseconds on PARAM Padma, over 55 days. The results clearly show sudden formation of semi-stable conformation from extended form within the first 20 nanoseconds (initial burst phase). This could be rated as one of the largest simulations in India.

Snapshots of MD simulation of villin headpiece, taken up to 38 nanoseconds(ns)

Expression of two genes can be positively correlated if they are regulated in a similar fashion under a given condition, which may be due to the presence of similar motifs in their upstream or downstream regions, acting as transcription factor binding sites for particular transcription factors. Such motifs can be detected using various motif detecting programs. The MEME program has been utilized to detect motifs in the upstream regions of 700 diurnal regulated genes of Arabidopsis using the PARAM Padma.

A generic tool for steady state metabolic flux balance analysis was also developed using Perl.

The Smith-Waterman algorithm is a pair-wise sequence alignment method used in comparative genomics that implements dynamic programming. The Code was completely developed in house and both serial and parallel codes have been developed. The integration of individual modules and testing is underway.

In the field of **Computational Atmospheric Sciences,** projects in collaboration with various academic and research institutes and agencies of national and international repute were executed on the PARAM series of machines deployed at C-DAC's premises in Pune and Bangalore.

Weather Forecasting models like PSU/NCAR mesoscale model (MM5 model), Regional Spectral Model (RSM), Portable Unified Model (PUM), Climate System Model and Weather Research and Forecasting (WRF) were adapted and simulations for the Indian region were carried out for atmospheric research at C-DAC.

In the category of ocean models, the Modular Ocean Model (MOM4) has been ported on PARAM Padma and simulations for the ocean carbon cycle are being undertaken in collaboration with CMMACS (CSIR Centre for Mathematical Modeling and Computer Simulations), Bangalore.
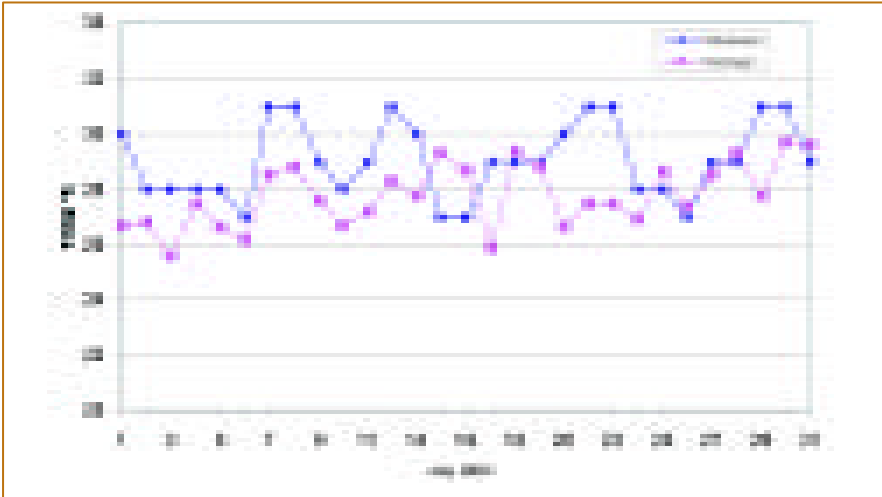
*Time series of observed and forecast maximum temperature over Bangalore*

An Environmental model **CALPUFF** was ported on to the PARAM machines and as part of the Pune Air Quality Management program under PMC-USEPA project, C-DAC is engaged in simulations for pollution forecasts for Pune City.

A GIS based Indian emission inventory useful for air pollution research has been developed in collaboration with the Indian Institute of Tropical Meteorology (IITM), Pune.
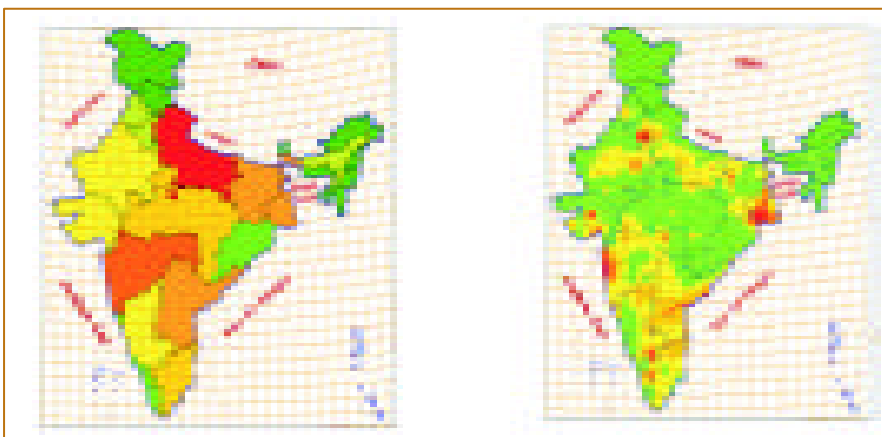
GIS-based Gridded CO Emissions statewise (initial) and gridded (1o x 1o)

As part of its **Computational Fluid Dynamics** applications, development of an Engine Simulation Software and Performance Optimization of Internal Combustion (IC) Engine was undertaken. A project for Performance Improvement of Shell & Tube Heat Exchangers was undertaken for the Department of Science and Technology (DST).
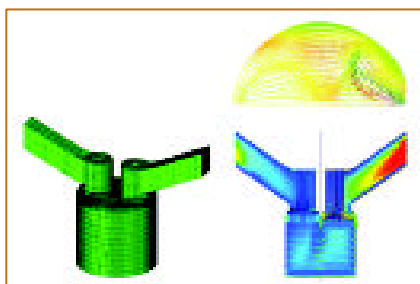
Numerical Simulation for Internal Combustion Engine

The **Computational Structural Mechanics** Group of C-DAC is engaged in Research & Developmental work in parallel processing in finite element analysis and its specialized applications.

Collaborative projects with IISc-Bangalore for the development of a parallel finite element code for fracture mechanics problems in 2D and 3D structures and another with IIT-Mumbai for the development of a parallel finite element code for thermo-mechanical analysis of FRP composites using higher-order flat facet elements were completed in December 2003.

The INTEGRA software version 1.0 for Modeling and Visualization of engineering structures was completed and released. For the convenience of users, the preprocessor and postprocessor functionalities have been integrated under one GUI; It finds applications in Computational Structural and Fluid Mechanics.

The activities of the **Evolutionary Computing** team concerned protein structure prediction, development of codes for IC Engine performance optimization and similarity search. Activities in the area of Structural Mechanics have been initiated with IIT Guwahati for the applications of evolutionary computing. A prototype tool based on genetic algorithms for similarity search was developed for a software company at Bangalore.

The **Seismic** group took up a Seismic Waveform Inversion project for the ONGC to develop and parallelize 2D model-based seismic waveform inversion algorithm based on Genetic algorithm and GLI techniques for estimating the material properties of the earth.

The **Theoretical Chemistry** group at the Department of Chemistry, University of Pune in collaboration with C-DAC, has been actively developing, improving and promoting the use of various ab initio quantum chemical packages on PARAM 10000 and the PARAM Padma.
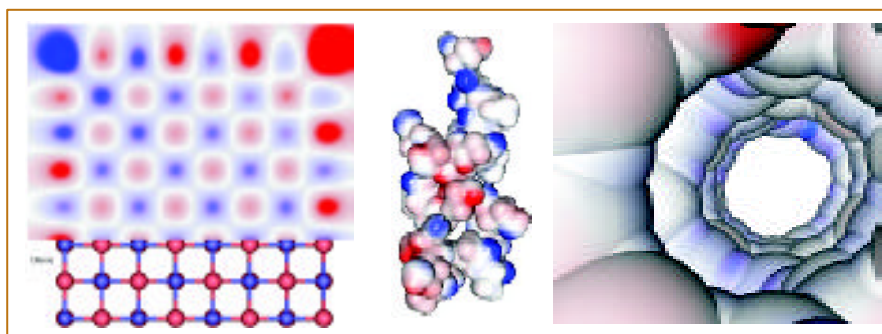
Molecular Electrostatic Potential Surfaces for large molecular system obtained by molecular Trailoring approach

MULTIMEDIA AND MULTILINGUAL COMPUTING

With the objective of further proliferating the use of IT in regional languages, a number of initiatives bore fruit. These include the development of Java based Vedic components for Vedic scripts, for use in digital libraries and Vedic text processing, development of Image processing components for Steganography and Graphic components for broadcast applications such as Character Generation, Tickers and Subtitling in Indian languages.

A project for EPSON, Japan, was undertaken, which involved having a language Engine embedded within the printer for draft / NLQ printing with various fonts sizes.

A generic digital library solution, named Virtual Museum Builder (VMB) has been developed for the integration, management, presentation, administration and subscription modules that help data entry operators and curators in processing the content.

Virtual Museum Builder

Dynamic Motion Editing

The research is aimed at creating a suite of techniques for enhancing the flexibility of virtual characters driven by motion-captured data. Existing schemes in this area suffer from rigidity and lack of dynamic control.

Multi depot, multi-vehicle scheduling problems occur in real-life in cases such as airline timetabling, city bus scheduling, and so on. The wide variety of constraints imposed by the different domains makes formal approaches unfeasible. A genetic algorithm based model was implemented at C-DAC, for airline timetabling and a number of studies were carried out regarding the impact of various parameters of the model on its performance and its effectiveness in solving the timetabling problem. This work formed the basis of a doctoral dissertation submitted to BITS Pilani.

Statistical models for Machine Translation

Given the difficulty of obtaining good quality translation from European languages to Indian languages using knowledge based approaches, there is increasing interest the world over in using statistical models based on large, annotated corpora. C-DAC is pursuing this model as part of its ongoing machine translation work. As a first step, an attempt was made to translate phrasal verbs using generalized examples. A Master's thesis was produced based on this line of work.

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For the ongoing **Bangla ESNOLA-based Text-to-Speech-Synthesis (TTS)System,** Statistical Rule Based intonation in the Read-out mode has been grafted.On the Bangla Speech Recognition front, a limited vocabulary feature-based recognizer has been developed and trials are ongoing regarding its background noise tolerance capabilities.

As part of the initiatives in Natural Language Processing in Bangla, a system for translating English sentence(s) to corresponding Bangla sentence(s) is underway. For this, the proven Angla-Bharti technology for Hindi developed by IIT, Kanpur under the Linux Operating system is being adopted with Bangla Text Generator, Bangla Lexicon, Paradigm Numbers and different Part of Speech rule-base for Bangla. On the Linux platform, the user interface has been developed in Java.

For the development of speech technology and speech research, standard annotated speech data (corpora) plays a very important role. The speech corpora provides the crucial voice segment to the researcher. A good speech corpus should contain the basic elements of speech research like acoustic phonetics and acoustic prosodic, in addition to the required data for speech technology development. C-DAC has undertaken a project on **'Development of annotated speech corpora for three East Indian languages (Bengali, Assamese, Manipuri)'.**

The content of the Speech Corpora can be divided into three parts according to the need of the Speech Technology Development and Speech Research viz: Speech Research, Automatic Speech Recognition and Speaker Recognition.

Creation of Speech Corpora according to the above requirements will involve Content Selection, Recording, Tagging, and Organization. The selection of content for Bengali for three categories of speech research has been completed.

The recording of the above content by different informants (male, female of different age group) of Standard Colloquial Bengali (SCB) is underway as is also proper tagging of the recorded sentences according to the corpora management methodology.

Annotated Speech Corpora for other Indian languages

The Annotated Speech Corpora developed in Hindi, Punjabi and Marathi will facilitate studying the acoustic, phonetic structures of Indian languages. The corpus contains multi-form speech units like phonemes, syllables and di-phones. This speech database is crucial for the development and testing of speech recognition and synthesis systems.

Test Bed for Machine Translation System

C-DAC has developed a Translation Workbench from English to Hindi. To popularize usage of the system and to test its accuracy, a workshop was held with members drawn from the academia, industry and testing organizations like STQC. A strategy to test the workbench was evolved and a bilingual corpus of 10,000 sentences was formulated for testing the system. The test results of the workbench with the corpus, established that the quality of machine translation in respect of quantitative, qualitative and statistical conversion qualities were acceptable to various users.

Multilingual Unicode Word Processor with integrated OCR & TTS

A multilingual Unicode Word Processor has been developed under the project and OCRs available in various languages have been integrated. Besides the normal text editing features, a Text to Speech Synthesis module is being embedded in it. The editor supports an editing facility for Hindi, Marathi, Tamil and Punjabi. It embeds utilities like Spellchecker, Transliteration, Calendar and Calculator.

Digital library projects

Carnegie Mellon University (CMU) has initiated a Digital Library Project for digitizing one million books. C-DAC is participating in the programme "Digital Library of India" under the same as a coordinated national initiative by the DIT. C-DAC is working to develop toolsets in three languages namely, Hindi, Punjabi and Marathi based on these contents. The design of some of the toolsets initiated include Cross-lingual Information Retrieval for Indian languages, Multilingual Crawler for Hindi, Punjabi and Marathi, Test Bed for Devanagari OCR with workflow, Multimodal Interface for the Physically challenged, Automatic search indexing tools, Multilingual and multimodal authoring tools, Text summarization in Hindi extendable to Punjabi based on available corpus and multimodal content management tool.

Handheld scanner based text reading machine for the visually impaired

The project was aimed at the development of a Hand Held Scanner Based Reading Machine, to enable the visually impaired to listen to printed material in Hindi and English. The system being jointly developed with CSIO Chandigarh comprises three integrated modules i.e. imaging hardware, Optical Character Recognition and Text to Speech Conversion.

TDIL portal and Language Technology Demonstration Facility

A TDIL portal has been maintained and updated with information on language technology developments and standards. The portal also extends regular services like Hindi E-mail Seva, Machine Translation and Samadhan Seva. The portal e-publishes the periodicals, calendar of events, links to related sites in bi-lingual (English and Hindi) mode.

The Language Technology Demonstration Facility (LTDF) demonstrates language technology products and tools through the TDIL lab at the DIT.
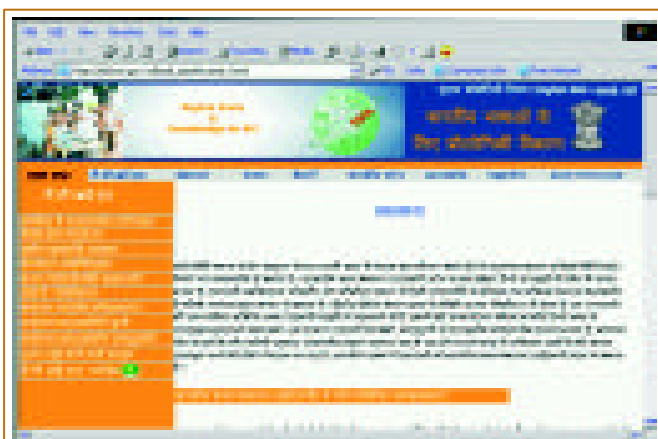
TDIL portal

Natural Language Processor for Intelligent Tutoring Systems

This project aims at developing a natural language processor for simple sentences to use as a front end for intelligent tutoring system for high school students.

The system is a natural language understanding system, which will be able to understand simple passages. A modified phrase-structure grammar parser is used as the main parsing method. The semantic analyser creates a Conceptual graph for the given paragraph of text.

As NLP projects can take as long as 5 to 10 years, for tangible results, the original scope of the project was decided as follows

- Natural Language Processor for handling up to 10 simple sentences and certain type of compound sentences at a time.
- Vocabulary of Sixth standard student
- Development of Concept Dictionary
- Development of Automatic Spelling Correction System
- Development of Modified Phrase Structure Grammar Parser
- Development of Semantic Analyser module to represent meaning of sentence in Conceptual Graph form
- Development of Inference Mechanism and Sentence Synthesizer

A significant achievement, other than those proposed in the project, has been the Development of a semantically classified vocabulary with 52 hierarchical noun classes and 62 verb classes. Also, different types of semantic rules with a new format and different thematic roles have been developed.

IT SECURITY AND NETWORKING

Establishment of a Data Center for e-Services

A state-of-the-art Data Centre with a live storage capacity of approximately 2 Terabytes expandable to 8 Terabytes, has been set up for extending world class e-Services to Govt. institutions and Corporate Houses. The Data Center activities include e-Learning, e-Procurement, e-Tendering, Web Services and MySAP services.

Cyber Security : Cyber Forensics Tool Suite

This indigenously developed forensics tools suite is meant for Disk Forensics and Network Forensics, to follow-up the implementation of the IT ACT–2000, especially with respect to cyber crimes. **The following Cyber Forensics Tools, have been developed for distribution among Law Enforcement Agencies of the country.**

TrueBack

TrueBack is a DOS application with event based DOS Windowing System. It performs a self-integrity check and minimum system configuration check. The other features of TrueBack are Minimum system configuration check, Extraction of system information, Three modes of operation, Seize, Acquire, Seize and Acquire, Disk imaging through Parallel port, Disk imaging using Network Interface Card, Block by Block acquisition with data integrity check on each block, E/SCSI, USB, CD and Floppy acquisition, Acquisition of floppies and CDs in Batch mode, Write protection on all storage media except destination media, Checking for sterile destination media, Progress Bar display on all modes of operation, Report generation on all modes of operation, BIOS and ATA mode acquisition.

CyberCheck

CyberCheck is the software for analyzing the disk image taken using TrueBack software. It is a Standard Windows application.

EmailTracer

EmailTracer is also a standard Windows application. It provides a facility for automatic extraction of Microsoft Outlook Express mailbox from the hard disk and a facility to list all the DBX files in the

system. The other features of Email Tracer are Display of extracted E-mail header information, Display of Actual Mail Content for Outlook Express, Eudora, MS Outlook and mail clients with MBOX mailbox, display of the Mail Attributes for Outlook Express, Display of the Mail Content (HTML / Text), save Mail Content as .EML, display of all Email attachment and Extraction, display of E-mail route, IP trace to the sender's system, domain name look up, display of geographical location of the sender's gateway on a world map, mail server log analysis for evidence collection and access to Database of Country code list along with IP address information.

EMBEDDED SYSTEMS

C-DAC integrated the Connax Conditional Access System (CAS) on its Set Top Box to meet the requirements of various MSOs like Zee TV. The technology partner M/s. Real Time Systems, New Delhi was facilitated to upgrade the design of the Set Top Box with enhanced Conditional Access System to be delivered to Zee TV. Another technology partner M/s. ITI Limited commenced the prototype manufacturing of Direct to Home (DTH) Set Top Box to provide access to free-to-air bouquet of channels being launched by Doordarshan and Zee TV.

TErrestrial Trunked RAdio

Biometric Access Control System

In order to meet the security requirements of various organizations, to check the identity of visitors and their movement, technologies have been delivered for Perimetry Protection System, Node Access Control System and Attendance Recording Systems. To provide advanced features on the existing technologies, Biometric Authentication System that confirms individual identities by examining a unique physiological trait or behavioral characteristic, such as a fingerprint, iris, retina or signature has also been developed.

The main features of the system includes Biometric security, Open Standard Authentication, Image Improvements, Multi Device support, Scalability, and so on.

Adaptation of Call Centre Technology for MTNL Garuda WLL services

A server based indigenous Call Centre solution was developed to enable Medium and Small Scale Enterprises to set up a Call Centre at low cost. Efforts were made to demonstrate the technology and popularize the same among SMEs and the utility services in the Corporate and Government Sector. The technology was customized as per MTNL requirements and implemented at their site for running the help desk of their WLL Mobile service "Garuda". The solution provided is bilingual

catering to English and Hindi. A customized CRM application for better customer handling was also developed and integrated with the system.

Further efforts to enhance the capabilities of the call centre solution, like dynamic IVRS are underway.

Development of OFDMA based rural communication system

For the purpose of interoperability, adaptive digital communication systems have become a vital requirement among Defence, Military, Civilian and Commercial Organizations. The digital devices are configurable, secure and adaptive to cater to the needs of the various transmission and receptive devices.

A Broadband OFDMA based Software Defined Radio (SDR) equipment for customer premises to provide rural connectivity has been designed and developed. The system is based on OFDM 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.

Smart Card Reader (eSmart PSR 100)

eSmart PSR 100 is a portable Smart Card Reader Terminal for transacting with Contactless smart cards complying ISO 14443A standards. This portable device is designed to support multiple applications like transportation, on-site vending and so on. Presently, it has been deployed for tea/snack vending at C-DAC.

Remote Inspection Device

The Remote Inspection Device is an equipment for monitoring environments into which human access is to be avoided . The equipment consists of two separate parts; a mobile capable of being remotely controlled and a suite of instruments mounted on the mobile for surveillance of the environment into which the equipment is introduced. The data gathered by the instruments is transmitted to a computer at the control station through a radio LAN. The development of the RID was a joint venture of C-DAC and BARC. The mobile, the control station, communication and control, and the video visual inspection system was developed by C-DAC and the instruments which formed the payload for the mobile were developed by BARC. The complete system has been commissioned at BARC, Trombay.
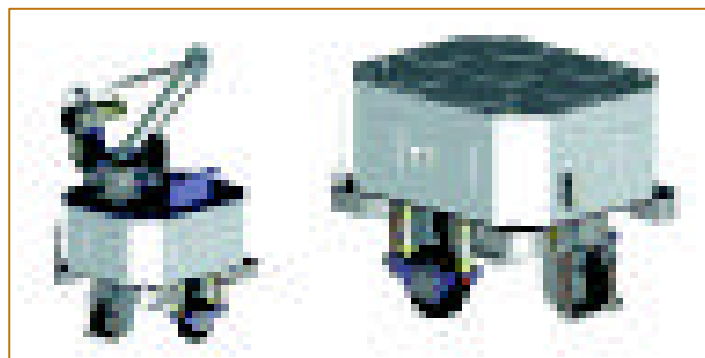
Remote Inspection Device

GEOMATICS

### Platform independent GIS Analysis Tool

A Platform independent GIS Analysis Tool has been developed with GIS functionalities for viewing and analyzing different attributes. Unlike other similar tools available in the market, this is an effort to develop an open source technology based system, which is a platform/database independent tool. The tool provides all the GIS capabilities like Zooming, Planning, Searching, Information browsing and so on. This also includes storage of spatial map data in any database along with the textual information. The map engine works both with Intranet and Internet environments without the need of conventional Internet Map Server.

### Land Management Information System for Delhi Development Authority (DDA)

A Land Management Information System for the DDA, involving land records automation, acquisition and utilization of land, and vectorization & digitization of maps, all fully integrated through the GIS stream, has been taken up by C-DAC. The development work of the first phase of the project has been completed and implementation is in progress. The next phase involving web enabling of the entire Spatial /Non-Spatial data is underway.

Agricultural Census

The project involves the creation of a large database of about 8000 million bytes at a national level. This includes development and implementation of an information retrieval system at the micro and macro level for decision-making.
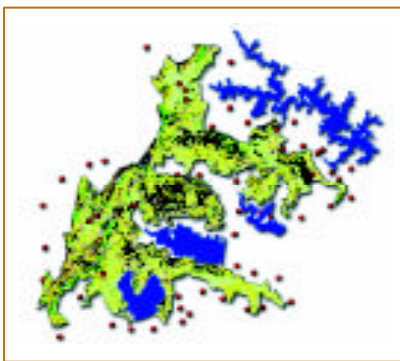
Biodiversity
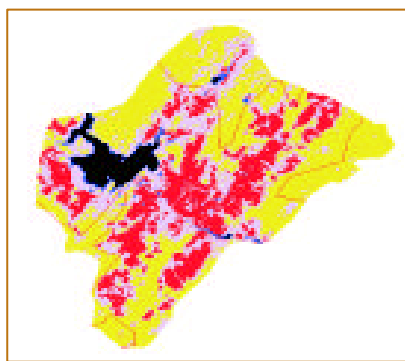
Landcover

The project, being simultaneously executed in various states and Union Territories on behalf of the Ministry of Agriculture, Govt. of India will facilitate development planning, socio-economic policy formulation and establishment of national priorities in the agricultural sector.

Large Terrain Visualization

The research is aimed at developing in-house expertise in this area. The area is relatively new and finds direct use in GIS and defense related applications.

C-DAC is working at developing a framework for providing web-based services in vehicle tracking, infrastructure, agriculture, biodiversity, snow monitoring and flood monitoring. A Vehicle Tracking and Information System (VTIS) in Maharashtra State Road Transport Corporation (MSRTC) buses along the Pune-Nasik route has been successfully demonstrated. The VTIS, based on GPS (Global Positioning System) and GSM (Global System for Mobile Communication) technologies, provides information on the location of vehicles and its movement in real time on the web.

In association with the Snow & Avalanche Study Establishment (SASE), C-DAC has demonstrated snow cover characterization and change analysis using remotely sensed data in optical range (IRS LISS III) and crevasse mapping using remotely sensed data in microwave range (RADARSAT I) and texture analysis.

TETRA TECHNOLOGY DEVELOPMENT

TETRA (TErrestrial Trunked RAdio) is a Professional Mobile Radio standard devised by European Telecommunications Standards Institute (ETSI) to combine Cellular Mobile Telephony, Packet Data and Digital Mobile Radio together on one open cellular platform. The objective has been to ensure that the TETRA standard will provide a broad range of communication services for professional users.

C-DAC has developed a total indigenous solution for Digital Mobile Radio Technology to TETRA Standard. These projects have been jointly initiated by DIT and BEL and the products developed are TETRA Hand Portable Radio, TETRA Vehicle mount Radio and TETRA Base Station. The key technologies/ modules developed for these products include Communication algorithms, Protocol Stacks for MS and BS, High Speed ADC & DDC, ARM & DSP based embedded architecture, RF Trans-receivers, RF linearised Power amplifiers and 4800MIPS cPCI based DSP card.

TETRA (TErrestrial Trunked RAdio)

OPEN SOURCE SOFTWARE

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 and human resources in this area. A portal for open source software is being developed. Specific proposals are being taken up to fund this effort from DIT and other sources including relevant industry.

Shri. K.K Jaswal, (Centre) Secretary, DIT, MCIT, launches IndiX at C-DAC

ONGOING PROJECTS

ASTRA - Innovative Intellectual Property Solutions

One of the most important aspect facing system-on-a-chip (SOC) designers today is availability of intellectual property (IP) cores. IP cores enable design teams to realise large system-on-a-chip designs by integrating pre-designed, pre tested blocks that do not require any further design work or verification. A range of IP cores, verified and validated extensively so as to meet the quality and reliability requirements of the present SOC designers have been developed. The innovative IP portfolio is code named 'ASTRA'.

Technology Transfer of Front End Converter

The objective of the project was to transfer the Technology of Front End Converter developed by C-DAC. C-DAC ported the control software to Emerson hardware and conducted successful tests to demonstrate the performance.

SPONSORED / CONTRACT PROJECTS

C-DAC's technologies and services have been deployed for a number of projects that have been sponsored and supported by various departments of the Government of India as well as by collaborating institutions in India and abroad.

DEPARTMENT OF BIOTECHNOLOGY (DBT)

EST analysis of Mosquito Genome

A two year collaborative project of the National Center for Cell Science (NCCS) Pune, C-DAC, Pune and the Microbial Containment Complex (MCC) Pune, funded by the **Department of Biotechnology (DBT)**, deals with extensive EST analysis of Anopheles Stephensi which is a vector of malaria in India. The sequencing of EST's will be carried out at NCCS and MCC. The sequence assembly, annotation and submission to international databases will be carried out by C-DAC.

DEPARTMENT OF INFORMATION TECHNOLOGY (DIT)

Ultrasonic Imaging System

The project aims at developing reusable hardware and software modules in systems based on Ultrasonic Imaging Technology. The hardware and software developed are adaptable for different applications. Possible applications are in Nondestructive Testing, Medical Imaging, Underwater surveillance, Harbour security systems, seafloor mapping and so on. The project was funded by MCIT.

GyanNidhi Multilingual Parallel Corpus

As part of this project, data in XML/HTML format was created in English and 11 Indian languages. The XML data has been aligned up to paragraph level. A Corpus management tool for this project has been developed for adding/ viewing/ saving the corpus files in various languages. The options provided enable the user to customize the screen to view the data. A statistical text analysis tool **"Vishleshika"** has been developed to provide various textual characteristics for linguistic studies.

Dware Dware Gyan Sampada

This pilot project involved setting up Digital Libraries on Mobile Vehicles to provide access to people in villages and remote areas. Encouraged by the success of the pilot project, the DIT has extended the project duration further for a period of one year.


Dware Dware Gyan Sampada

Bioinformatics Resources & Applications Facility (BRAF)

The Bioinformatics Resources & Applications Facility (BRAF) of C-DAC provides a high-end supercomputing facility to the Bioinformatics research community with remote access to the existing Bioinformatics software available on the PARAM Padma. The BRAF will assist the academia and industries to accelerate their research or product development.

Seismic Prestack Migration and Velocity Analysis

The primary aim of the project is to develop and parallelize some prestack migration algorithms to generate image gathers.

Two parallel prestack migration algorithms have been developed. Both the codes have been tested on a SEG/EAGE overthrust data set. The codes have been ported and tested on PARAM 10000 and PARAM Padma.
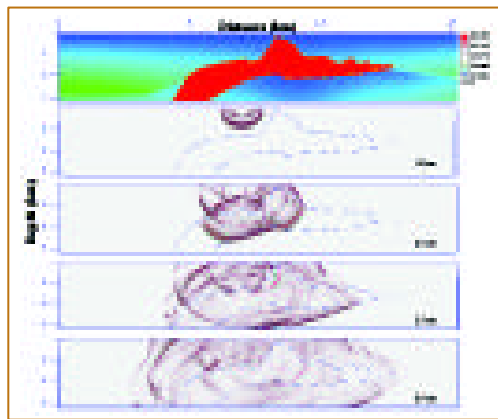
P velocity model of SEG/EAGE Salt model and the snap shots

Seismic Traveltime Tomography

As part of the "Fast Track Project" scheme, this project is aimed at the development of an efficient and robust two-dimensional seismic traveltime tomographic inversion scheme using real coded genetic algorithm. The developed scheme will be parallelised on the PARAM series of supercomputers.

Development of Telemedicine Technology

The project 'Development of Telemedicine Technology' being implemented by C-DAC, was granted an extension with an enhanced scope. The Telemedicine Network implemented 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 & Research (PGIMER), Chandigarh, is to be extended to cover three Medical Colleges at Shimla, Cuttack & Rohtak. The new linkages recommended are SGPGIMS & S.C.B Medical College (Cuttack), PGIMER & Indira Gandhi Government Medical College (Shimla) and AIIMS & Rohtak Medical College (Rohtak).

Setting up of TeleMedicine & TeleEducation 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 setup identified TeleHealth Services in the State of Kerala viz. TeleConsultation and TeleEducation for Continuing Medical Education (CME)

For setting up the TeleConsultation service, C-DAC will customize and deploy its Telemedicine Technology, Mercury™, C-DAC's Integrated Telemedicine Solution™. Appropriate Hardware & Connectivity will be set up for the purpose at four Remote Telemedicine Centres (RTC's) and at three Telemedicine Referral Centres (TRC's); to coordinate & facilitate the Telemedicine Interactions, a Telemedicine Referral Hub (TRH) will be set up.

The Remote Telemedicine Centres (RTC's) will be set up at District Hospital, Kollam, Taluka Hospital, Neyyattinkara, Taluka Hospital, Quilandy and District Hospital, Malappuram. These will be equipped with Clinical Equipment like ECG Machines, Video Microscopes, and so on, and Patient End Software, to create and transmit the Electronic Medical Record of the patients. The Telemedicine Referral Centres (TRC's) will be set up at Medical College Hospital (MCH), Sri Chitra Tirunamal Institute of Medicine Science & Technology (SCTIMST), Regional Cancer Centre (RCC). Thiruvananthapuram Medical College (TMC) will provide opinions through the TRC at MCH. These will be equipped with Specialist End Software. The Telemedicine Referral Hub (TRH) will be set up at the Medical College Hospital.

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

C-DAC has been awarded a prestigious project to set up telemedicine facilities in two states of the North East, in association with the Apollo Telemedicine Networking Foundation (ATNF). The telemedicine centres would be set up at two state level hospitals, which would be connected, to the Super Specialty Apollo Hospital.

Under the project, C-DAC will deploy its Integrated Telemedicine Solution, Mercury™, at the identified hospitals.

For the duration of the project, the Apollo Hospital will provide free consultation to the identified hospitals using Mercury™. The Telemedicine Centers will be operated for a period of 18 months.

E-Security: "Design and Development of a Transparent Solution for Securing Networks and Systems"

The project aims at designing an end system integrated security solution, transparent to the applications and covering the Network, Transport and Application Layers of TCP/IP stack for Windows and Linux Operating Systems. PRSG members reviewed the SRS and design of the solution.

Two Training Programmes on **"e-Suraksha: A practical approach to Network Security"** were conducted for Government organizations. As part of this project, the centre also established an e-Security Concept Lab, developed the software for demonstrating various network security related tools, technologies and products and trained user organizations in network security.

e-Learning

Development of component-based functionality to e-Learning tools, a sponsored project from DIT was completed. The components (Course Organizer, Assessment, Collaboration, Query Handler, Formula editor, Virtual lab) developed were integrated to e-Sikshak and also to an open source LMS "CLAROLINE". The e-Learning framework "e-Sikshak" was successfully tested by running an online course titled "Core Competency in Software Process Management (CCSPM)".

Another project, "Design and Development of an Online Course Content on Cyber Security" to be offered in the e-Learning mode envisages the development of 20 modules of Cyber Security course content covering a wide spectrum of topics such as security concepts, security architectures and models, OS security, web security, VPN, cryptography and so on, to be offered online.

e-Learning

Supply Chain Management

A R&D project titled "Design and Development of an Affordable Supply Chain Management System for the SME Sector", will be implemented in association with the International Institute of Information Technology (IIIT), Hyderabad.

Data Mining

A new project being jointly undertaken with the Indian Institute of Chemical Technology and C-DAC,will develop an Integrated Information System for the control of Bancroftian Filariasis in Andhra Pradesh. The main objective of the project is to design and develop a Database Management System for Epidemiological, Entomological and Socio- Economic parameters of Filariasis, using data mining tools for predicting the vector abundance and disease transmission for the control of filariasis and Mapping the endemic zones based on the severity of the disease using GIS.

Application of Image processing Techniques for Improved Feature Extraction in Echocardiography related to Cardiac Diseases

A Medical Image processing software has been developed with a view to improve the performance of existing echo machines.

Development of isolating tools for steganographic images

The objective of this 18-month project is to analyse the stego-images obtained from the Internet or, any other source like seized computers. The analysis includes detection of hidden messages, extraction of message bit streams and finally reconstruction of hidden messages. An integrated software package has been developed and handed over to concerned user groups for validation and usage.

National Resource Centre on Steganography

A STEGO CHECK software has been developed to detect the existence of secret communications by terrorists. The developed software works on digital images. An image sniffer collects Internet

images from suspected IP addresses, which are then passed through different hierarchical filters according to their formats. The filters check the images and declare the existence of hidden information. In some cases the software is able to extract the plain English text message hidden in the image.

Steganography

Integrated Automation of Tea processes

This three-year project sponsored jointly by the Ministry of Commerce, CSIR and the DIT is almost complete. Installation of machinery and process control infrastructure has been completed and the system commissioning and software fine-tuning are underway.
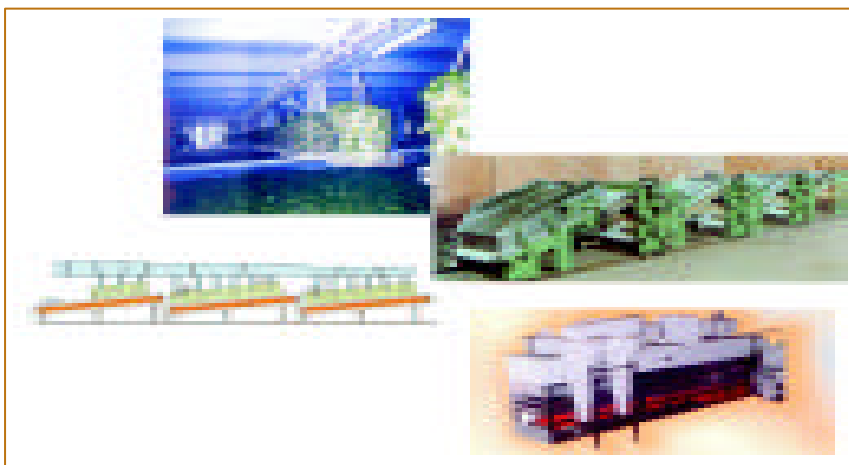
Tea production

Digital Library Mega Centre: Language Technology and Content Development

This project aims at developing core technologies for Digital Library CLIA, Multilingual Crawler, OCR with workflow, Multi Media Interface for the physically challenged in Bengali, Automatic search indexing tools, Multilingual & Multimodal Authoring tools, Text summarization in Bengali, Multimodal Content management tool with a focus on Bengali and Assamese. It will also include Centre-specific Technology Development for Search & Retrieval of Bengali Folk Songs.

Small Business Solution on Handheld Device

The System under development will facilitate e-commerce with electronic maintenance of accounts of Small-businesses with online secured transactions between a Handheld computer and data stored at the Application Service Provider's Computer.

After the initial design of the accounting solution on iPAQ in WinCE and EVB environments, the first version of a Simputer based Solution on Linux with ASP-end database module on MySQL has been completed.

The N@G project

The N@G project carries out research and development in the area of network & system security and to deliver an intrusion detection system with analysis and response capabilities.

The 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-NS (N@G Network sensor) is ready for pilot testing with the following Detection capabilities: Signature Detection, Network Access Policy Violation, Statistical Analysis and Protocol Anomaly Detection.

N@G-HS (N@G Host Sensor for Linux 2.4.x): Implementation of Audit trails through system call interception to create Audit reports.

N@G-NS has been pilot tested at C-DAC.

Other projects undertaken and completed with the support of the Ministry of Communications and Information Technology are listed below.

DIT, MCIT SPONSORED PROJECTS

Development of RISC Processor Core

Network Integration of Power Electronics Systems for Automated Process

Ultrasonic Imaging System

Software Defined Radio (SDR)

Natural Language Processor for Intelligent Tutoring System

IP Telephony

Indix Phase 2

Encryption Technology for TETRA System (ETS)

Design Development & Field demonstration of Mobile Remote Terminal Units

Design and Development of IEC 61499 Based Intelligent Device (IECSCADA)

Design and Development of Intelligent SCADA in retrofit automation

Intelligent Battery Mgmt. Charge Control System for Unattended Solar Photovoltaic Installations

Development of Universal Serial Bus IP Core (USBCORE)

| |
|---|
| Power Assisted Bicycle (CAMP) |
| Development of PV inverter with Utility interconnection (PVINV) |
| CAN Based Embedded Controller for Automotive Application (A-CAN) |
| Parametric Sub-Bottom Profiler |
| Harbour Security System (HSS) |
| MEMS based Seismic Sensor (MSS) |
| Ultrasonic Liquid Level Sensor (ULLS) |
| Resource Centre for Malayalam Language Technology solutions (KAIRALI) |
| Vector Control Induction Motor Drive for Hybrid Electric Vehicle |
| Design and Development of Black Box for automobiles. (in affiliation with Punjab Technical University) |
| Speed System for Handicapped. |
| Pilot Training for Upgradation of PCO Operators to Cyber Communication Operators. |
| TETRA Base Station |
| Watermarking Digital Audio & Setting up of a Resource Centre for Digital Rights Management System |
| Lawful Interception of VoIP Traffic (LIVoIP) |
| Digital Programmable Hearing Aid |
| Distribution Automation System for Thiruvananthapuram city- Phase II |
| Custom Power Devices |
| Technical Resource Centre for Cyber Forensics (TRCCF) |
| ATM based plant-wide Networking for Bhilai Steel Plant |
| Development of Area Traffic Control System and it's Implementation (ATCS)) |
| Democratic Infra-structure for Administration through Multi-Objective Network Depository (DIAMOND) |
| Human Resources Portal (HR PORTAL) |
| ONCONET-Cancer Care for Rural Masses |

DEPARTMENT OF OFFICIAL LANGUAGE (DOL)

LILA-PPP on Web

Web-LILA is a web-based extension of the LILA Technology. In this series, online language tutors for five Indian languages - Hindi, Gujarati, Bengali, Telugu and Tamil are being designed and developed. Web-LILA facilitates a simulated environment of a virtual classroom session, wherein an on-line teacher would be available (at a pre-determined time) for interactions with the students and to address subjective queries and clarify doubts. The software can be accessed on http://lilappp.cdacindia.com/ and www.rajbhasha.nic.in
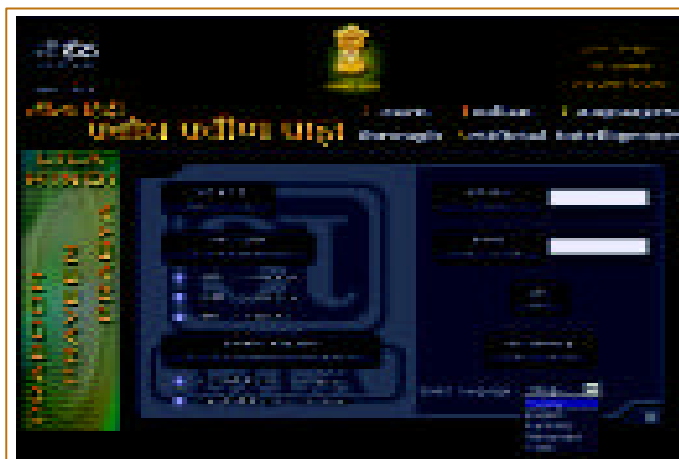
LILA-PPP on Web

DEPARTMENT OF SCIENCE AND TECHNOLOGY (DST)

CD ROM on Life & Work of Srinivasa Ramanujan, the Mathematical Genius

C-DAC's National Multimedia Resource Centre has completed the development of the first multimedia CD ROM on Life & Works of Srinivasa Ramanujan the Mathematical Genius' with the help of the Institute of Mathematical Sciences (IMSc), Chennai. The team has digitized and integrated three Notebooks of Ramanujan (approx. 700 pages), collected research papers (approx. 400 pages), biographies (150) and around 250 old photographs.

CD ROM on Life & Works of Srinivasa Ramanujan the Mathematical Genius

Preparation of Landslide Hazard Zonation Atlas

As part of the project, the Geomatics Solutions Development Group will synthesize the existing multi-thematic and landslide hazard zonation maps of various DST sponsored projects. NATMO will publish the generated information in association with C-DAC.

Biodiversity characterization at landscape level using satellite remote sensing and GIS

Being undertaken in association with IIRS, Dehradun, and funded by the DST and the DBT, Phase I of this project has been successfully undertaken in the Western Ghats of Maharashtra. Remote sensing data from Indian satellite (IRS LISS III) will be used for mapping the types of forest . The maps along with field data will be analyzed to assess the status of biodiversity in the forests of Madhya Pradesh. The information, thus generated, will become a part of the Biodiversity Information System (BIS) hosted on the Internet using Web-GIS.

OTHER PROJECTS

Pilot Scale Production of Audio-Video Aid for teaching Indian Languages
Fifty samples of Sarthi-2 were produced and handed over to various centres of NLM for field trials. The feedback is being collected.

CCDN

CCDN is a project funded by Development Gateway Foundation, USA being executed by DGF ICT-R&T Centre located at C-DAC - EC, Bangalore.

The Community based Content Delivery Network (CCDN) is an initiative towards building of e-Communities and moving the content closer to the user.

Content Management System for Communities (CMS4C) is the first step of CCDN's initiative, which enables the formation of an e-Community. CMS4C is a Content Management System for rural communities designed to work in resource-constrained environment. It provides mechanism to create, capture, share and utilize local knowledge of the e-Community.

The first release of CMS4C was deployed at DHAN Community Centre, Melur, Tamilnadu.

Ne@Samhain

Samhain is an open source file integrity and host-based intrusion detection system for Unix and Linux, under GNU General Public License. Ne@Samhain is an extension to Samhain, which is being built at C-DAC. Ne@Samhain offers System Recovery, and Check for hidden processes.

Cross Lingual Information Retrieval

As part of the DGF funded ICT R&T centre, C-DAC is addressing the problem of Cross Lingual Information Retrieval (CLIR). This project will enable the non-English speaking community in India to search and access English-language content of the web. The work builds on existing machine translation capability (MaTra) at C-DAC and focuses on the health domain. A prototype version is almost complete.

Shruti Drishti

Shruti Drishti is a Computer Aided Text-to-Speech and Text-to-Braille System for the visually impaired. The objective of this project is to design, develop and integrate C-DAC's Extractor and Vachantar applications with Webel's Text - to - Braille, emboss-printer, Braille script viewer and tactile reader to enable the visually impaired to listen to the proceedings of Conference Websites. This project is funded by Media Lab Asia and has been successfully delivered. It was demonstrated at the Asian IT Minister's Conference in January 2004 at Hyderabad.
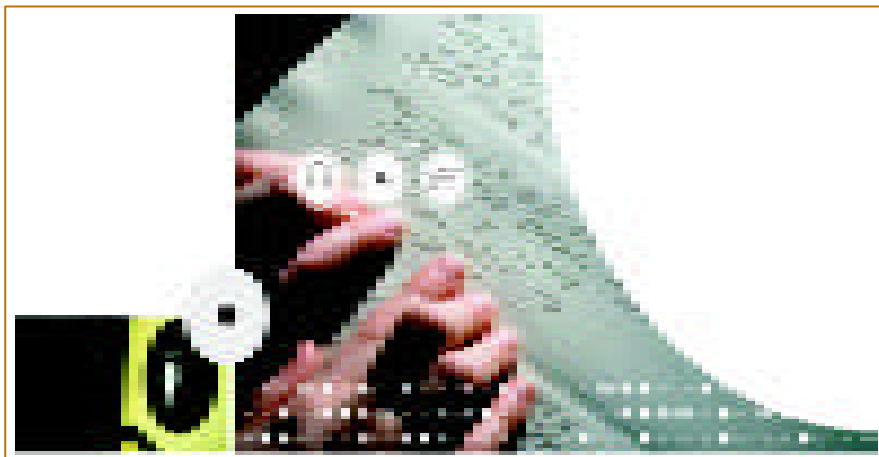
Shruti Drishti

Speech System for the Handicapped

This is a Text - to - Speech System aimed at those with a speech handicap. The system is a portable, handy system and can be carried anywhere by the user.

Exploratory studies on development of Electronic Nose for Tea

The project starts with a thorough investigation study and identification of primary and overlapping flavour elements in black tea made in various parts of India in consultation with scientists of TES, Tocklai, other academic institutions and bio-chemists experienced in the Tea Industry. On the basis of this study, an organoleptic data matrix will be developed which will be the base for feature extraction, classification and decision making followed by an approach towards electronification of the concept leading to exploratory studies towards the development of the electronic nose. The project is funded by the NTRF, Tea Board

Studying landscape dynamics with emphasis on landuse/landcover change vis a vis carbon sequestration and habitat loss

Being undertaken in association with IIRS, Dehradun, this project will use space borne remote sensing data coupled with geo-spatial modeling techniques to estimate carbon sequestration patterns in the western ghats of Maharashtra. The study will seek to reveal the dynamics of the forest ecosystem and role of forests in harvesting carbon dioxide from the atmosphere.

DGF R&T Centre

The main objectives of the Centre are to carry out applied research and development in ICT, specially tailored to three domain areas namely, Healthcare, Education and Agriculture. The initial focus to achieve the above will be through applied research in major technology areas namely, Internet,

Language and Speech Technologies. IIT Mumbai is the principal collaborator in this programme to develop solutions in the research areas of Internet Technologies and Database Access Technologies.

Small and Medium Applications for Rural Technicalization SMART

The SMART group has developed an application intended as an information exchange / sharing tool for use by rural communities. The application was developed with inputs from DHAN foundation, Madurai. Currently it has been deployed at DHAN foundation kiosks in Melur, Tamilnadu.

Healthcare solutions

The healthcare team has developed an application, e-Kamps, which provides features for planning, conducting and analysing camps. It is a web-based application with interfaces for different healthcare personnel to organise camps. It is used for resource planning and allocation for camps and also as a data-gathering tool during camps.

The healthcare team has initiated collaboration with the HERBS society, Pondicherry to develop a healthcare management system.

BharateeyaOO

BharateeyaOO project which was started with an aim to bring OpenOffice.org in Indian languages by CDAC Electronics City made significant progress on many fronts during the year.

1. Localized version in Marathi available and activities initiated in other languages like Kannada, Telugu, Gujarati and Malayalam through various other groups.
2. Transliteration Framework for Indian Languages.
3. Promotion of Localized OpenOffice in NGOs and Government institutions like Barefoot College, American India Foundation, Bank of Baroda etc.

BharateeyaOO

Matrubhasha

Matrubhasha was visualized with the objective of building a framework, which could 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. Considerable progress has been made in almost all areas of speech synthesis in Indian Languages, particularly development of tools for Linguists, Libraries for Software developers and Plug in architecture for End-users.

FOREIGN SPONSORED PROJECTS

Eurostack I (completed)	Securicor Wireless Technology, U K
Eurostack II	Software Radio Technology, U K
Advanced Hand Portable TETRA Mobile Radio (CDART-1)	Software Radio Technology, U K
LRC-Kozhikode (LRC-C)	Association of Kerala Medical Graduates (AKMG), USA and Medical College, Kozhikode

COMPLETED SPONSORED PROJECTS

ToT of Front-End Converter	Emerson Network Power (India) Pvt. Ltd, Mumbai
Vehicle Management System With Voice Communication (VMS-VC)	Trinity Comnet PVT.Ltd , Palakkad.
Supply of Linux Based Control System for TTPL, Thiruvananthapuram (LBCS)	Travancore Titanium Products Ltd., Thiruvananthapuram
Hospital Management System	Cosmopolitan Hospitals, Thiruvananthapuram
Development of a Layered Modeling and Simulation Architectural Framework for DARPAN	NPOL, Kochi
Design, Development & Validation of Test Vectors	VSSC, Thiruvananthapuram
Data Acquisition System	Durgapur Power Ltd.

ONGOING SPONSORED PROJECTS

Development of Power Consumption Monitoring System	Bhilai Steel Plant (BSP)
MCH TVM Computerization (Computerization of Medical College Hospital, TVM)	Medical College, Thiruvananthapuram
Distributed Intelligent SCADA for TCFHP PS-II & III	West Bengal State Electricity Board
DME Computerization (Computerization of Directorate of Medical Education)	Directorate of Medical Education

DHS Computerization (Computerization of Directorate of Health Services)	Directorate of Health services
DAME Computerization (Computerization of Directorate of Ayurveda Medical Education)	Directorate of Ayurveda Medical Education
DISM Computerization (Computerization of Directorate of ISM)	Directorate of Indian System of Medicines
DH Computerization (Computerization of Directorate of Homoeopathy)	Directorate of Homoeopathy
Urban Traffic Control System (UTCS) ToT (Webel)	Webel Mediatronics Ltd, Kolkata
UTCS ToT (Meltron)	Meltron, Mumbai
TETRA Hand-held Radio	BEL, Bangalore
On Line Message Controller (OLMC)	AdNews, India
Position Locating System (PLS)	FOCUZ, Infotech
Remote Inspection Device	BARC
Power Supply card for Mirage Aircraft	Air Headquarters
MIS for ICDS	Social Welfare Department
Development of UW Ranges Goa	NSTL, Vizag
Master Plan for Health MIS (HMIS)	Department of Health & Family Welfare, Kerala
Technical Consultation for Kollam DCB Computerization	District Co-operative Bank, Kollam
Consultancy for implementation of Core Banking Solutions at Kerala State Cooperative (KSCB_CORE)	Kerala State Co-operative Bank, Palayam, Trivandrum
Technical Support for Implementation and Monitoring of Akshaya Connectivity (AKSHAYA-2)	Kerala State IT Mission
IT Implementation of Tailor Board Activities (WELFARE_TRB)	Kerala Tailors Welfare Fund Board
Development of 70 KW drive and AC motor for Battery Powered Vehicles	BHEL, Bhopal
IT Implementation of Toddy Board Activities	Kerala Toddy Workers Welfare Board
Vehicle Tracking and Monitoring (VTMU)	VSSC, Trivandrum
Fabrication of 10 Nos of SPIL Boards (SPIL_BOARDS)	ADA, Bangalore

ADVANCED TECHNOLOGIES LEADING TO MARKET SOLUTIONS

C-DAC's core technical capabilities and solutions have been deployed as spin offs in a wide range of projects that address issues of ICT and economic, scientific and commercial segments of the economy. These are highlighted as follows :

Crop Acreage Estimation

This project has been awarded by SAC, ISRO. The present phase of the project involves identification and mapping of the extent and spatial spread of four major crops, namely rice, wheat, mustard and sugarcane within the state of Uttar Pradesh, using single and multi date optical as well as microwave remote sensing data to provide pre-harvest single/ multiple forecasts.

High Performance Computing Laboratory Project

C-DAC has signed a Memorandum of Understanding (MoU) with the Jawaharlal Nehru University (JNU), to set up a High Performance Computing Laboratory on the JNU campus. C-DAC would be assisting the faculty and researchers at JNU in solving large scientific problems using this facility. Bioinformatics would be one of the key areas of focus.

Design & Development of Black Box for Automobiles

C-DAC, in affiliation with the Punjab Technical University has designed and developed a black box for automobiles. This will aid in measuring the health of a vehicle, in terms of parameters like speed, alcohol detection, overload detection, front camera to capture the last 5 frames, and so on.

AssetAnalytics

A Portfolio Management Software was developed for and deployed at the "State Investment Corporation Limited", the biggest funding company in Mauritius. The Portfolio Management System primarily allows the users to construct, monitor and manage a financial portfolio. The "State Investment Corporation Limited", Mauritius, sponsored this project

Design and development of RCA Project Database System for International Atomic Energy Agency (IAEA), Vienna

IAEA has an RCA programme that funds various projects in Asia region. In order to track the resources generated by these projects, a system was developed on .NET platform. The system has been installed at their premise at Vienna.

Calypso Project

Calypso is an application integration environment for Aeronautical Development Agency (ADA), Bangalore. ADA has applications existing on multiple platforms, connected via an intranet. This integration environment allows management and control of the applications. The user is able to invoke and control the application on other machines on their network through a password protected web interface. The results of the application executed are displayed to the user through the web interface.

Low Cost Digital Library Solution for Prince of Wales Museum (POWM), Mumbai

The Digital Library solution is designed to address requirements such as digitization, data entry, data verification and approval, rights management, web publishing, access control and so on. POWM being the user agency has partly funded the development.

Pilot Scale Production of Audio-Video Aid for teaching Indian Languages sponsored by the Ministry of Human Resource Development (MHRD)

Fifty samples of Sarthi-2 were produced and handed over to various centres of the NLM for field trials.

RT Linux device drivers

A project to develop RT Linux device drivers for on board computer has been secured from the Research Centre Imarat (RCI), DRDO, Hyderabad.

Design and development of Cordic based array processors for implementation of a PC based Colour Do ppler Ultrasonography System

The objective of this project is to extract better clinical features from ultrasonography images. The developed algorithm improves the Signal to Noise Ratio (SNR) of the echo-images by utilizing the statistical properties of speckle noise. These developed algorithms are tested on real images and handed over to IIT, Kharagpur for FPGA implementation.

Design, Development and Implementation of Management Information System (MIS) in Integrated Watershed Development Project (IWDP), HP

Funded by the World Bank this project aims at the development of a Management Information System/ Geographical Information System (MIS/GIS), which will facilitate in speeding up the pace of local processing and transmission of data to central/ head offices and the dissemination of processed information to all work-sites in a near real-time environment.

Identification of hilly zones within PMC Limits

This project funded by the Pune Municipal Corporation (PMC) involves the identification of hilly zones within PMC limits using high-resolution satellite imagery. The project will provide accurate information on contours and slope parameters of the hilly regions. This information would be used by the PMC to delineate zones of restriction to control the development on hilltops and hill slopes.

Subscriber Billing and Payment System of Calcutta Telephones

The Subscriber Billing and Payment Accounting System of Calcutta Telephones has been converted to handle the new concept of Plan-based Billing introduced by BSNL. The meter calculation and billing modules have been changed to take care of various plans announced by BSNL from time to time.

Creation of training courseware using interactive multimedia in regional languages

A complete IT anchored curricula with an interactive multimedia based courseware for imparting quality education synchronously at multiple locations has been prepared.

Prof. Robert Gagne's basic steps of Instructions Design have been followed to shape this learner-centric model of educational courseware. This has been designed using an in-house developed Integrated Development Environment (IDE). Self-evaluation has been built-in as an essential component of the system.

Supercomputing Facility for the University of Hyderabad

A contract to set up and manage a "Supercomputing facility" for the University of Hyderabad was secured. The user base includes students, researchers and international collaborating projects.

Hospital Management System (HMS)

The design and development of an integrated Hospital Management System (HMS) with standards HL-7, HIPAA, DICOM, SNOMED, ICD, covering the following modules such as Clinical Services, Support Services, Back Office Services and Man-Machine Interface Services has been initiated.

The deployment of this application software is underway at G.B.Pant Hospital, Port Blair and General Hospital, Chandigarh.

Seismic Data Migration and Storage Consolidation Project

ONGC selected C-DAC through a global tendering process for implementing the storage consolidation project for ONGC's GEOPIC at Dehradun.

C-DAC has implemented a "Storage Area Network" based on Fiber channel Technology to connect the UNIX, LINUX HPC servers and FC-AL based storage arrays. The heterogeneous file systems, Storage Area Network, Disk Arrays and Archive Tape Libraries have been configured for management and monitoring from the central storage software.
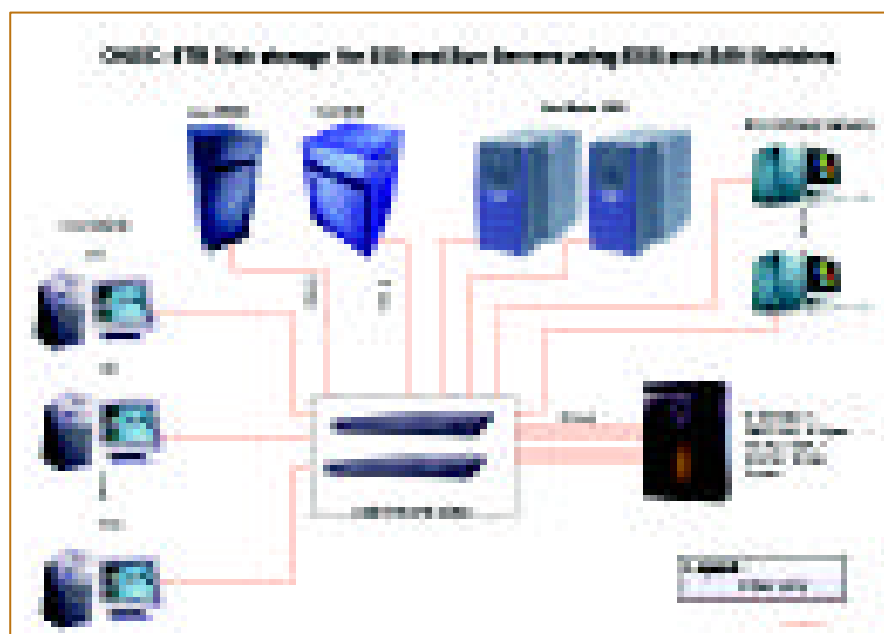
ONGC: 5TB Disk Storage for SGI & Sun Servers using ESS & SAN

Open Source and Information Infrastructure Projects

Chattisgarh Electricity Board, HEMRL Pune, NIO, Goa are some of the major customers to whom infrastructure solutions have been provided by C-DAC.

Goa Online-Governance architecture based on standardized Metadata Structure

The project is aimed at providing e-Governance solutions to the State Govt. of Goa. The deliverables of the project are Meta data structure preparation, birth & death registration, e-Governance common modules - personnel information management system, finance management system, budget information system, e-Governance specific applications for secretariat- accommodation software, vehicle

management system, library management system, file tracking system, inventory management system and portal development. Of these, meta data structure preparation, e-Governance common modules and e-Governance specific applications for the state secretariat have been completed and are ready for deployment.

DOEACC Online Project

The scope of the project includes re-engineering of business processes relating to students' Registration, Examination, Valuation and Certification, Institutes' Accreditation, Interaction with Experts and Porting of previous data.

Northern Railways

A number of packages have been developed and deployed at the Northern Railway HQ/Divisions and other Zonal Offices.

One of the systems developed and deployed was the **Integrated Transaction Accounting System (ITAS)**. The system, capable of handling all accounting functionalities of the Indian railways along with Provident Fund and deployed at the Northern Railways, North Western Railways and North Central Railways and their Divisions was maintained by C-DAC.

C-DAC also developed the **Civil Engineering Management Information System (CEMIS)** for the Indian Railways, which has been implemented at the Northern Railways. This system has a 3-Tier Architecture and fulfills all the requirements of the Civil Engineering Department of the Indian Railways. This system facilitates the planning of track renewal to disposal of scrap material. Encouraged by the success of the implementation in the Northern Railways, the same is being replicated at Southern and Central Railways.

The **Security Management Information System (SMIS)** is an on-line Management Information System developed for the Railways Protection Force and has been successfully implemented at Northern Railways. After successful implementation of the system in Northern Railways, the same has been deployed in Southern and Central Railways.

C-DAC's **Personnel Management Information System (PMIS)**, a web-based application, caters to the requirements of the Personnel Department of the Indian Railways. It manages the career path of employees starting from induction to superannuation. The first phase has been completed at Northern Railways Headquarters, Delhi Division. Implementation at DLW Varanasi is in progress.

In the 2nd phase of the project, development of modules covering employment regulation, staff grievances, policies, dak and file management, welfare activities and so on, has been completed. Implementation is underway at the Northern Railways HQ and the Delhi Division.

Inventory and Sales Management System, Indian Tourism Development Corporation

The objective of the project was to develop a system to automate the operations of the Duty Free Shops (DFS) at different International airports across the country, managed by ITDC from the Hq's. The system covering Sales, Purchase, Costing, Indent, Inventory, MIS modules and Exception Reports has been designed, developed and implemented on a turnkey basis.

Loan Accounting System for Apex Corporation of National Finance Development Corporation(NFDC)

The objective of the project was to computerize the Loan Accounting System of five apex corporations of the NFDC under the Ministry of Social Justice & Empowerment. The system has been developed and deployed in the following four apex corporations:

- National Backward Classes Finance & Development Corporation (NBCFDC)
- National Minorities Development & Finance Corporation (NMDFC)
- National Scheduled Caste Finance & Development Corporation (NSFDC)
- National Handicapped Finance & Development Corporation (NHFDC)

Web Enabled Financial Accounting System NAFED

This is an integrated web enabled Financial Accounting System for NAFED. This package would be used in their Regional & Branch offices. Data consolidation will be done at the Head Office. The main modules covered in the system are : Financial Accounting, Voucher Entry System, Day Books, General Ledger, Trail Balance, Balance Sheet, Cost Center Reports, Income Tax, MIS and Inter office voucher transfer.

Range Technology Centre, Under Water Ranges (Goa)

The Range Technology Centre (RTC) of Project Under Water Ranges (UWR), Goa is a pioneering Scientific Project in Vasco-da-Gama.

C-DAC was the prime contractor and responsible for execution of the complete project on a turnkey basis. The data handling system and electronics in the offshore part were fully developed and installed by C-DAC.

Technical Activities
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Advanced Technologies

e-Governance Projects

Project	Client
SRS of Claims Processing System	Naval Dockyard, Visakhapatnam
MoU	CSEB
PIMS	Naval Dockyard, Visakhapatnam
NCMS	Directorate of Public Relations, Chattisgarh
Networking	CSEB
AMC & EIS	MLS
Annual Maintenance Contract	IGR, Maharashtra
ISP Study	CSEB
Land Registration	IGR, Goa
Preparation of Software for 15 years Index data Entry and Encumbrance Certificate Module	IGR, Karnataka

Graphics and Intelligence based Script Technology (GIST) building blocks and tools were used in the following projects of national importance:

1. Individual Market Yard Project - executed under the aegis of APMC (Agriculture Produce Marketing Corporation) & ECIL (Electronic Corporation of India). The scope of this project was to computerize the transactions undertaken by the farmer to take agricultural produce to the market. This project has been initiated in Hyderabad covering a large part of Andhra Pradesh.

2. Dial your Chief Minister, Andhra Pradesh - This is live programme telecast weekly by Doordarshan. The entire live telecast uses the MOVE CG & Multiprompter supplied by GIST.

3. ISFOC Script Manager (ISM) is used for providing Indian language interface to the Library Automation Software Inflibnet. This is used by over 500 libraries across the country.

4. Bilingualization of Integrated Enterprise Solution Application developed by CMC for the Reserve Bank of India deployed across 300 locations in RBI across the country. GIST tools for Linux & Windows have been integrated along with this application.

5. Nepal Electricity Authority, Dena Bank, Central Bank, Bilingualization of the Jharkhand Chief Minister's transaction process is carried out using C-DAC GIST tools.

International Projects

C-DAC deployed an 8-node PARAM Padma at the India-Ghana Kofi Annan Centre of Excellence for Communications and IT at Accra, Ghana.

C-DAC had been entrusted with the complete responsibility of setting up the Linux based multipurpose HPC Facility at the Centre and to conduct a training programme for its faculty to meet the intensive application requirements of the Centre. A Linux workshop and PARAM Padma System Administration training was conducted by C-DAC at Accra, Ghana.

The India-Ghana Kofi Annan Centre of Excellence for Communications and IT was inaugurated by the Hon'ble Prime Minister of India on December 09, 2003.

Hon'ble Prime Minister of India, Shri Atal Bihari Vajpayee inaugurates the India-Ghana Kofi Annan Centre of Excellence for Communications and IT at Accra, Ghana, through live Video Conferencing from New Delhi. Inset : A view of the India-Ghana Kofi Annan Centre of Excellence for Communications and IT

EDUCATION AND TRAINING

C-DAC's Education and Training programmes continued to build and enhance skills in critical areas of Information Technology and electronic product development throughout the nation.

C-DAC is recognized by major corporates in India to be a high-end provider of education and training in areas of Information Technology.

Some of the flagship PG programmes have been well received by the industry as shown by enthusiastic support given by companies like Honeywell, Tata-Elixi, Wipro, and Infosys.

1. Post Graduate Programmes

Sl.No.	Courses	No. of Students
1.	Master of Computer Applications (MCA)	178
2.	Master of Technology (M.Tech-IT, VLSI & CSE)	92
3.	Master of Engineering (Electronic Product Design & Tech)	19
4.	Post Graduate Diploma in Software Technology (PGDST)	324
5.	Advanced PG Diploma in Software Technology (APGDST)	94
6.	Post Graduate Diploma in Internet Technology (PGDIT)	18
7.	Post Graduate Diploma in Advanced Software Design & Development (PGDASDD)	163
8.	Diploma in Advanced Computing (DAC)	718
9.	Diploma in Embedded Systems Design (DESD)	180
10.	Diploma in VLSI Design (DVLSI)	40
11.	Diploma in Geo Informatics (DGI)	9
12.	Diploma in Advanced Computer Arts (DACA)	142
13.	Graduate Diploma in Emerging Information Technology (Grade IT)	200

2. Other Programmes

Sl.No.	Courses	No. of Students
1.	Advanced Diploma in Enterprise Networking	37
2.	Advanced Diploma in Industrial Automation & System Design	18
3.	Competency Test in Software Technology (CST)	5226

C-DAC also conducts short duration programmes in collaboration with IIT-B, Kanwal Rekhi School of IT.
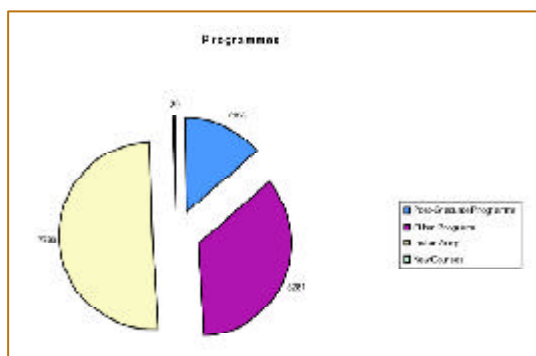
Distribution PieChart of Training Programmes

3. Programmes Conducted for the Indian Army

C-DAC has been retained by the Indian Army to conduct specific training programmes for the officers throughout the nation. The details are as under -

Sl.No.	Courses	No. of Students
1.	Advanced Diploma in Information Technology	242
2.	Diploma in Information Technology	3953
3.	Certificate course in Computer Operations	3191
4.	Diploma in Data Communications & Networking	239
5.	Diploma in Data Communications and Security	30
6.	Diploma in Geo-Informatics	51
7.	Diploma in Database Technologies	90

4. Online Education & eLearning Programmes

eVidyapeeth Online Campus as well as e-Sikshak were used to complement C-DAC's traditional training programmes.

Pre-DAC programme was successfully managed by eVidyapeeth Online Campus that saw an enrollment of over 1000 students from across the nation. It was a 3-month long online programme that prepared students to appear for C-DAC's Common Entrance Test (CET)

5. New Programmes

Sl.No.	Courses	No. of Students
1.	Diploma in Internetworking & System Administration (DISA) in Hyderabad	**120**
2.	Japan-to-India IT (Hiyaku-IT) programme were held in Pune. Engineers from Japanese companies like Toshiba and Topan are sponsored to undergo training for 3 months in areas of Embedded Systems, Project Mgmt and cross-cultural training.	**19**

6. Corporate Programmes

Specialized, customized National level Corporate Training Programmes were organized for the Indian Air Force, CSMRS, BARCO, Ministry of Agriculture and so on. During the year, the DACNET programme was also successfully undertaken.

CONSULTANCY
SERVICES

THE CORE EXPERIENCE GARNERED BY C-DAC OVER THE YEARS INTO DIVERSE TECHNOLOGY DOMAINS HAS ACCREDITED ITS STATUS AS AN INSTITUTION OF CHOICE AMONG THE INDUSTRY FOR ITS CONSULTANCY SERVICES TO SEVERAL KEY PROJECTS AND PRODUCT DEVELOPMENT ACTIVITIES.

CONSULTANCY SERVICES

Technical Consultancy for Akshaya Project

C-DAC was the technical support agency for the prestigious Akshaya project of the Government of Kerala. Akshaya project aims at providing computer literacy to one member each of the 65 lakh families in Kerala. Akshaya also aims at bringing better Government service delivery mechanism to the common man.

The pilot project has been implemented at Malappuram district, where more than 600 Akshaya centers have been set up. Each Akshaya center caters to about 1000 families. The Akshaya centers are equipped with a minimum of six computers in client-server configuration with the necessary peripherals.

All the 600 plus Akshaya centers have been connected through wireless network. The technology adopted is a combination of WiLAN, WiPLL and WiFi. The Phase I implementation of the network has been completed.

After the successful implementation of the pilot project at Malappuram, the Government of Kerala has announced the statewide rollout of the project in the new financial year. C-DAC is now providing consultancy for this (AKSHAYA Phase II) phase.

C-DAC was appointed the apex consultant to the Govt. of NCT of Delhi. The role and responsibilities included:

- Formulation of Road Map for IT implementation in various departments of the DIT, Govt. of NCT of Delhi

- Formulate metadata model for DIT, NCT of Delhi and other departments of the Govt. of NCT of Delhi

- Formulate IT security policies in respect of applications

- To propose standards for programming documentations

- To propose methodologies for back up and recovery

- Formulate requirements posed by various departments of the Govt. of NCT of Delhi

- Understand existing IT solutions/applications, if any and suggest whether to expand the application or modify or discard or revamp totally.

- Hand hold departments to enable users to understand the utilities of IT solutions in respect of their departments

ERP Consultancy Programmes

ERP Consultancy provided to the customers in Government/Corporate Sectors is based on the expertise gathered from the usage of several ERP packages like SAP R/3, People Soft, Oracle, Navision and so on. During the year several programmes for various technical and functional modules were organized, benefiting the industry.

Consultancy Services
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IT Infrastructure Development/Management Services

Networking project for Prasar Bharti

A major system integration project for 76 locations of Prasar Bharti was undertaken and completed successfully.

Setting up of Community Information Centres (CICs)

23 Community Information Centres (CIC) with 24 hours connectivity were established in the state of Jharkhand for a project awarded by the State Government of Jharkhand.

Other Services

C-DAC continued to provide IT management and consultancy services to the **Greater Noida and Noida Authorities.** The scope of work included maintenance of property management software, customization, applications development and providing hand holding support.

ONGC Ltd retained C-DAC as consultants to set up clusters and **Virtual Reality centers at five of their centers**. These projects would be executed in three phases, one of which has been successfully completed.

C-DAC has been appointed as a State Level Agency (SLA) to the Chief Electoral Officer (CEO) of Maharashtra. C-DAC is responsible for assisting the CEO, in implementing all the activities for computerizing the Election process in the state.

SONY Consultancy

C-DAC offered consultancy to SONY Entertainment Technology for the design review of their database system, and to develop converters for file formats.

Services Contracts

C-DAC was the consultant to the State Bank of India to certify the Data Centre for Core Banking set-up at the facility in Mumbai by a third party.

C-DAC has a Memorandum of Understanding (MOU) with the Sardar Patel University (SPU) Gujarat as a technology solution partner in the design, development, and deployment of Information technology solutions in a variety of SPU's operations.

An MOU with the National Institute of Oceanography, Goa, explores Joint Collaborations in the field of scientific projects, which includes the areas of Ocean Modeling, Seismic Data Exploration, Visualisation and Computer Aided Taxonomy Information System (CATIS),setting up of High Performance Computing Facility in NIO, Goa and undertaking projects in various areas of mutual interest.

An MOU with the Directorate of Technical Education (DTE) Mumbai explores the design and development of software to automate the admission process for various faculties of the DTE.

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RESOURCES FACILITATING

THE STRENGTH OF C-DAC'S CAPABILITIES AND SKILLS HAS ITS ROOTS IN THE VAST TECHNOLOGY INFRASTRUCTURE CREATED TO AUGMENT ITS DRIVE FOR CUTTING EDGE TECHNOLOGY DEVELOPMENT AND FACILITATE ITS RESEARCH INITIATIVES.

HINDI CELL

With a view to strengthening the usage of Hindi particularly in IT, C-DAC has developed several tools and technologies using natural language processing. Downloads of some of the newly introduced packages are available at http://www.cdacindia.com. C-DAC centres also introduced various administrative forms and literature in Hindi.

LIBRARY AND INFORMATION CENTRE

The C-DAC libraries across all centers have a rich collection of books, publications, journals, conference proceedings, manuals and CD's on a wide range of technical and general interest subjects, including, Supercomputing, Parallel Computing, Computer Graphics and Animation, Software Technologies and Practices, Networking and Communications. Apart from the regular activities like procurement of books, subscription to journals, circulation of books and journal issues, binding, processing and circulation of softwares and so on, a reference service is provided to the staff with the help of Libsys database, enabling online searches and Inter Library Loan.

Specialized services include Web-enabled Newspaper Clipping Service (E-clippings) extended to all centres of C-DAC on a daily basis. This is a current awareness service bringing the IT related news-items appearing in leading dailies, to the notice of C-DAC members.

C-DAC organized a one-day seminar cum presentation on Electronic Information Products. The Electronic Information resources included Science Direct, J-Gate, Safari-Tech Books Online, Emerald and CD Mirror Technology

VIGILANCE, GRIEVANCES AND LIAISONS

As per the directives of the Government, a vigilance officer oversees the vigilance related issues at all the centres of C-DAC. Senior members have also been nominated as Grievance officers & Liaision officers for reserved category members.

HUMAN RESOURCES DEVELOPMENT

The Human Resources Development Team at C-DAC has 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.

During the financial year 2003-04, the Information Technology industry saw a boost in its activities and there was an overall resurgence in this sector. As a result, the attrition rate of human resources moved up to 27% from the earlier years of 9%. This attrition rate is still lower than the industry average. 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.

HR Plan

In the year under review, C-DAC conducted 133 training programmes and 875 members benefited from this training and development initiative.

KNOWLEDGE MANAGEMENT AND QUALITY INITIATIVES

Several innovative designs and developments were registered for Patent . These are listed below:

- Traction-Steering Synthesizing Mechanism
- Digital Controller Architecture for Hybrid Vehicles
- Dynamic Power Manager UPS
- Wireless Controlled On-line Fault Monitoring
- IR Elapsed Counter for Road Traffic Signals
- Optical Slip Ring
- EuroStack 1 Protocol Stack for TETRA

C-DAC developed novel techniques for Bootstrapped Direct sequence spread spectrum interface (BDS), Wireless Code Division Label Switching Router BDS Wireless Local Area Networks. These have been submitted to the Department of Information Technology, for patent registration.

C-DAC Thiruvananthapuram secured an **ISO 2000:9001 certification** for the Design, Development, Supply, Installation, Commissioning, Turnkey Implementation, Maintenance, Customer Support, Consultancy and Transfer of Technology of Products and Systems in the area of Electronics and Information Technology; the certification was based on the audit conducted by STQC (DIT), accredited by RvA, Netherlands, facilitating international validity for the ISO 9001:2000 certification.

WORKSHOPS CONFERENCES & EXHIBITIONS

IN ITS BID TO STAY ABREAST OF THE GLOBAL TRENDS IN TECHNOLOGY AND INITIATE THE LEARNING CYCLE FOR EMERGING TECHNOLOGIES, C-DAC HAS ORGANIZED A NUMBER OF CONFERENCES AND WORKSHOPS FOR ITS MEMBERS AS WELL AS THE SCIENTIFIC COMMUNITY. THESE EVENTS SERVE AS IDEAL PLATFORMS FOR INDUSTRY INTERACTIONS AND OPENS NEW AVENUES FOR KNOWLEDGE SHARING AMONG THE INDUSTRY AND SCIENTIFIC COMMUNITY.

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MAJOR CONFERENCES / SPECIAL EVENTS ORGANIZED

C-DAC organized several key events and conferences in the current financial year.
These include :

- One-day brainstorming session/workshop on "NLP needs from Speech Technology" at Kolkata on May 14, 2004.

- One day brainstorming Session on Electronics Nose & its applications at Kolkata on Aug 18, 2003.

- A 3-day module on "Evolutionary Computing" for the students of the Advanced Course in Bioinformatics (in collaboration with IICT and JNTU) during September 8-10, 2003.

- A 10 lecture course for Bionformatics students of the University of Pune on optimization techniques during February-March, 2004.

- A Training programme on PHOENICS CFD software was conducted at the National Institute of Technology (NIT), Trichy during June 2003 and University College of Engineering, Burla during September 2003.

- IJCAI International Joint Conference on Artificial Intelligence - is the foremost AI conference in the world attracting over 2000 participants. The well known conference series KBCS, held every two years was organized by C-DAC, Mumbai.

- A seminar on Industrial Application of CFD Simulation at Pune on October 14, 2003.

- A Training Programme on PHOENICS CFD Software at Pune during October 15-17, 2003.

- A one-day, "Symposium On Computational Challenges In Bioinformatics", was jointly organized by C-DAC and IBM life Sciences at C-DAC , Bangalore on November 5, 2003.

- Seminar on "Cyber Crime: Are we ready ?" at Hotel Oberoi, New Delhi on November 28, 2003.

- Workshop on "Development of Annotated Speech corpora for Indian languages" at C-DAC, Noida during July 17-18, 2004.

- A workshop on 'Machine Translation System Evaluation Techniques' at the DIT, Electronics Niketan, New Delhi during September 22-23, 2003.

- International Conference on Digital Libraries 2004 (ICDL) was organized jointly by The Energy Research Institute (TERI) and C-DAC, Noida at New Delhi during February 24 -27, 2004.

PARTICIPATION IN EXHIBITIONS

C-DAC has participated in the following events for the current year under review.

INDIASOFT 2004

The IndiaSoft 2004 Exhibition was held at the Taj Palace, New Delhi, during February 10-12, 2004. C-DAC was the co-sponsor for this mega event and showcased its entire gamut of HPC applications and the PARAM Padma. C-DAC was a joint participant in the exhibition with the Russian Indian Centre for Advanced Computing Research (RICCR), Russia and scientists from both the institutions demonstrated varied applications on the PARAM Padma.

ASIAN IT MINISTERS MEET

C-DAC participated in the 2nd edition of the Asian IT Minister's Summit at Hotel Taj Krishna, Hyderabad during January 12-13, 2004.

PARAM Padma and the grid prototype connecting PARAM 10000 in Pune, PARAM Padma in Bangalore and a PARAM Padma node set-up in the conference hall of the Summit were demonstrated. C-DAC's ManTRA, Vachantar, Anveshak, e-Sikshak and Nashir were also showcased.

ELITEX 2003

C-DAC participated in the Electronics & Information Technology Exposition (ELITEX) 2003 organized by the DIT, MC&IT, Govt of India at India Habitat Centre, New Delhi during April 28-29, 2003. C-DAC launched four new products namely, C-Crypto, Nashir, D-View and the Mobile Digital Library during the exposition.

LINUX ASIA 2004

C-DAC participated in the Linux Asia 2004 Conference at the Indian Habitat Centre, Lodhi Road, New Delhi during January 11-13, 2004. Dr. Sarat Chandra Babu, Centre Head, C-DAC, Hyderabad delivered an invited talk on "Open Source Security" with a focus on Linux Security at the event.

IITF 2003

C-DAC was one of the participants of the 23rd India International Trade Fair (IITF 2003) at New Delhi during November 14-27, 2003. The event was inaugurated by the Hon'ble President of India.

COMMUNICATION & PROMOTIONAL MATTERS

COMMUNICATION IS A VITAL IMPERATIVE TO C-DAC'S ACTIVITIES. THROUGH ITS CORPORATE POLICY, THE ORGANIZATION ENSURES A FREE FLOW OF INFORMATION AND TRANSPARENT COMMUNICATION ON ITS INITIATIVES TO STAKEHOLDERS AND MEMBERS OF THE PUBLIC.

C-DAC CONNECT

C-DAC Connect, the house magazine of the C-DAC symbolizes the spirit of networking and camaraderie, amongst members of C-DAC, spread across 11 Centres throughout India. As a quarterly publication, Connect assimilates the effervescence and endeavors of the institution through news, events, initiatives, breakthroughs and achievements. It seeks to 'connect' members, families, external audiences, which include officials in the parent organization, clients, former C-DACian's and C-DAC watchers namely, members of the media, members of the scientific community and so on. The house magazine also serves to facilitate as a forum to exchange essays on new and emerging technologies and trends in IT.

In the matter of content, C-DAC Connect strives to strike a balance between serious technical topics and soft stories, to serve a mixed palette of highly tuned, informative and yet entertaining articles to the readers. It offers opportunities to share success stories (In Profile), news, views and occasionally even trivia, while the Cover Story leads the technical and C-DAC centric theme of the magazine. The design elements reinforce the content specific to each segment woven in tandem with a common thread that unites the entire magazine in a composite whole. The photographs enhance the visual experience.

The year has seen four issues of C-DAC Connect covering in-depth and far reaching articles on technical issues like Cyber Security, Cyber Forensics, Intrusion Detection Systems, VoIP, Cryptanalysis, Broadband and Wireless Technology, TETRA, Bluetooth and so on, while also providing interesting and captivating content in the form of interviews, member profiles, news, product showcase and so on.

C-DAC Connect is a mirror of the organization in terms of its values and belief, and as such every issue becomes a mouthpiece for each member with a responsibility to inform and be informed.

AWARDS

In keeping with its high standard of achievements, C-DAC has been honored with a number of awards in recognition of its high end technological expertise. The awards include:

- Two Society for Technical Communication (STC) – India Chapter Awards for its Phoenics Brochure in the Technical Publications – Information Materials category and for its PARAM Padma Brochure in the Technical Art – Information Material Design category on December 12, 2003.

- Gold Icon Award in the 'Exemplary e-Governance initiative' category for SARITA at the 7th National e-Governance Conference at Chennai during November 13-15, 2003.

- IBM achievement award for bagging the largest storage project in the country was presented to C-DAC on February 12, 2004.

OTHER ACHIEVEMENTS

Membership of C-DAC in European Union's select list of EvoNet

Under the European Union (EU) 6th Framework Programme for Research (FP6), and an S&T agreement between EU and India, interests were solicited from Indian Research organizations to participate in the areas of Information Society Technology, Life Science, Genomics and Biotechnology for Health, Nanotechnologies, intelligent materials and new production processes and Aeronautics and Space

Based on the expression of interest and in depth evaluation by independent experts and their credibility, organizations are chosen to receive EU support as the selected best research partners of the consortium.

EvoNet, the European Network of Excellence in Evolutionary Computing, promotes collaborative research in the above areas, as an instrument of FP6

EvoNet has granted membership to the HPC Business Computing Group (HBCG), of C-DAC as an industrial node. C-DAC is in fact the only industrial node in the Asia-Pacific region.

The EvoNet Network of Excellence brings together active European researchers and practitioners in the field of evolutionary computing. Originally set up in 1996 with European Commission funding, the EvoNet network provides coordination, support and a web-based infrastructure for research and training activities, helping to share European expertise in evolutionary computing and to stimulate greater commercial interest in collaborative projects.

By joining EvoNet, C-DAC is now listed amongst the most distinguished names in the field of Evolutionary Computing.

Domain Registrar

C-DAC, Mumbai continues to be the Domain Registrar for the country code top level domain ".IN" for India and operates the .IN registry on behalf of the .IN domain of the country.

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Shri Arun Shourie, Hon'ble Minister for Disinvestment and Communications and Information Technology hands over the CD of C-Crypto to Dr R Chidambaram at ELITEX 2003.

Shri H C Srikantaiah, Hon'ble Minister of Revenue, Govt of Karnataka and Shri D Satyamurty, IGR, Karnataka at the handing over ceremony of C-DAC's KAVERI Solution at Pune. Also seen in the picture is Dr N Karir, IGR, Maharashtra.