Annual Report

2011-12

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING
www.cdac.in

Governing Council

(As on 31 March 2012)

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Overview

The year 2011-12 saw a number of significant developments and initiatives in C-DAC – both in technology development/ deployment and in organisational processes. On the technical side, we have significant progress being reported on all of our thematic areas, as detailed in the rest of this annual report. We have about 200 publications including a number of papers in international conferences and journals. The numbers of patent applications are increasing, thanks to more awareness on this across C-DAC.

In the high performance computing area, there has been significant increase in the number of applications using PARAM supercomputers for solving practically significant problems. With the growing interest in green computing and concern about the power consumption of supercomputing systems, active efforts are also on to optimise power consumption for HPC systems through a variety of interventions. We have now made foray into the field of cloud computing, with an open-source based cloud stack, named Meghdoot, now operational with some e-governance applications on board. More applications on the cloud are in the pipeline from various centres. The tremendous role played by Grid computing technology in the discovery of the so-called God Particle is an example of the importance of high performance computing technologies today. And high performance computing continues to be a major component of C-DAC R&D space. C-DAC is also actively involved in India's plans for building the next generation of supercomputers.

Language computing has always been a strong area within C-DAC. Last year has seen C-DAC focusing on use of Indian languages on mobile and handheld devices. We have also released three courses involving Sanskrit, as part of our heritage computing focus. C-DAC has been active in a number of consortia projects on machine translation, information retrieval, character recognition, etc where we work with leading academic institutions to build deployable systems in these areas. A recent notable venture has been the support for Indian languages in defining domain names.

Mobile computing is a relatively new emerging area, and C-DAC has a number of activities around this theme - for example, as service delivery platform for e-governance and as information access mechanism for applications such as agriculture, education and transportation.

Completion of the acoustic mine detection system, initiation of a comprehensive project on smart card technology, and a comprehensive project on electronics for agriculture and environment involving a number of partners and spanning a number of sub-projects were significant developments in the area of professional electronics. We continue to develop significant technology solutions to provide cost effective technologies for India, as well as to meet our strategic requirements. Given the concerns around the availability and demand for electric power, power electronics is an important part of C-DAC's electronics R&D.

In the space of e-learning, the achivements include adaptive instruction delivery framework for enhancing the personalisation in e-learning, technologies for education of cognitively challenged, development of virtual laboratories for school subjects, and successful rollout of the national online examination system. Customised Linux distributions have been compiled for users with various disabilities, to enable them to use technology more effectively.

Information security is another significant area of focus within C-DAC. Enhancing our solutions in the cyberforensics for the new generation of technologies and platforms (e.g. mobile devices), and building security solutions for various aspects such as web applications, mobile devices, portable storage media, cloud services, etc are among the R&D agenda today.

We have growing numbers of deployments of hospital information system, telemedicine systems, BOSS, etc. We have entered into an MoU with UIDAI, since there are a number of technologies of interest to UIDAI where C-DAC has expertise, experience, and tested solutions. These include Indian language solutions for transliteration and biometric solutions - both priority areas for UIDAI. C-DAC is also an active player in implementing the MHRD initiative of Akasha, providing an affordable tablet computer for students.

In the area of education and training, significant efforts have been made on consolidation and building of a common brand image. Common naming conventions for post-graduate diploma courses, common entrance examination, etc are now being introduced. We also have a number of training programs aimed at women, SC/ST, North East, etc empowering them to move ahead into the knowledge society. C-DAC has a plethora of activities focused on the North East, in line with the Government of India directive, using computing technology to address locally relevant problems and competence building.

C-DAC has laid the base for consolidating the multitudes of URLs originating from different centres, to be brought under www.cdac.in as the all-encompassing web presence for C-DAC. All R&D, training, and product information will be available through this portal. An integrated HRMS for management of human resources is nearing completion. A new model of project development, involving multiple centres and a centre-independent management structure is being implemented, to bring in better synergy and ownership. For information sharing across centres, monthly webinars where each centre makes detailed presentation on ongoing technical activities have also been introduced. All these are expected to bring in better uniformity and coherence in C-DAC's activities, and will help realise the vision of a unified C-DAC.

On the whole, it has been a year of consolidation and growth for C-DAC. And we are looking forward to more challenging avenues and addressing the challenges facing the nation through appropriate technological interventions.

Technical Areas

HIGH PERFORMANCE COMPUTING

HPC Technologies

Reconfigurable Computing System (RCS)

The small form-factor, high performance FPGA based hardware accelerator cards developed by C-DAC for reconfigurable computing, was successfully tested and certified for the CE and FCC compliance. This indigenously designed Reconfigurable Computing solution primarily consists of two components: RC hardware and the programming environment called Varada. The RC has remarkable computing capabilities (application performance equivalent to around 200 CPU cores). Apart from the Linux support, Varada for Windows 7 and Windows 2008 Server was also released.

Power Optimization of HPC Systems and Facilities

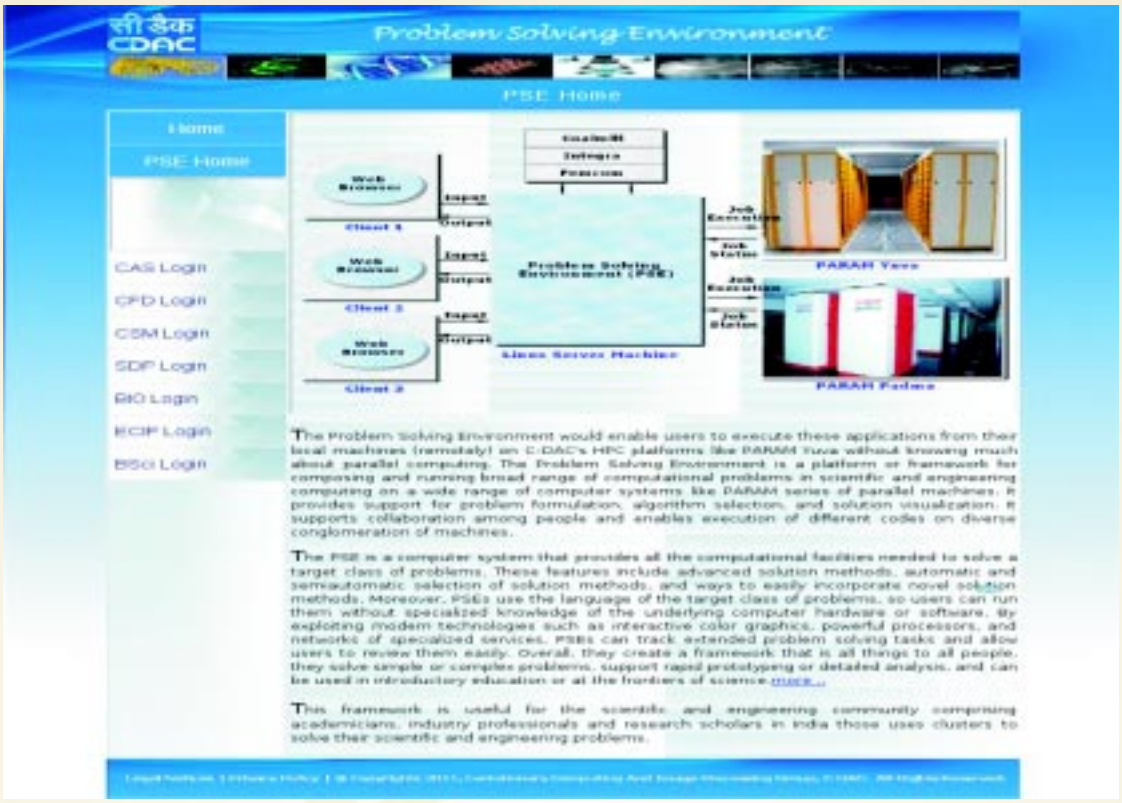
The Core-funded Power Optimization of HPC Systems and Facilities is a three-year multi-center (Pune, Thiruvananthapuram, Bengaluru and Chennai) project initiated in 2011 to investigate techniques and technologies to reduce power consumption in HPC facilities. Integration of such power-saving methodologies have become essential for viable HPC facility operation. Current research has indicated that up to 30% power may be conserved with such techniques.

The rapidly rising cost and environmental impact of energy consumption in High Performance Computing Systems has become a big concern globally. The need and usefulness of high performance computing systems and facilities in Business as well as Scientific & Engineering Applications is unquestioned and is growing rapidly, so the power consumption of high performance computing systems and facilities has become critically important and must be efficiently managed. High Energy consumption also translates into excessive heat dissipation which in turn, increases cooling costs and causes the system to become more prone to failure. In response to these concerns a solution is needed for reducing power consumption at a wide range of spatial and temporal scales. This project has four components, separately examining different aspects of power saving within a facility, including power supply and distribution, cooling, power-aware job-scheduling and intelligent, agent-based, self-managing systems for power management.

The first component is an exploration and analysis of different SMPS architectures, algorithms for active filters and STATCOM deployment options, and the design of the most efficient scheme for the PARAM Yuva HPC facility. The second component is an investigation into facility level power measurement and management using ZigBee (wireless) technology to control lighting, PACs and air quality. The third component is the development of power-aware scheduling software to control power states of compute nodes by using workload characterization and implementation of policy frameworks to optimize power consumption and meet QoS requirements. The final component is to design and develop an intelligent agent-based framework, that is, a software framework which provides an intelligent platform for system management including power and performance at various nodes of HPC Systems and Facilities. This approach presents a framework and general methodology for hierarchical autonomic power and performance management in high performance computing systems and facilities. This framework will also address an intelligent agent-based approach to achieve specified power and performance.

HPC Applications

Problem Solving Environment (PSE): The GUI of the PSE for scientific computing has been redesigned. The PSE has two main modules: a) User PSE that has screens for entering user profile, feedback, message-board messages, and for downloading job submission status and other output files, and b) Admin PSE, which has databases update screens for updating machine information, PSE software, user details, feedback control, etc.



PSE Home Page

Hybrid GA-SVM and ACO-SVM for Process Engineering & Chemo- Bioinformatics Applications: Support Vector Machines (SVM) could be used in Process engineering for fault detection and in Chemo-Bioinformatics for Protein function identification. In this work, we had employed hybrid combinations of Support vector machines-Genetic Algorithms and Support Vector Machines-Ant Colony optimization. Our novel algorithm which facilitates incorporation of domain information in the form of filter ranking has performed well and for a variety of real life problems. We also parallelized the algorithm.

Generalized In silico identification of Protein Function: Methodologies employing Ant Colony Optimization (ACO) and Random Forest for informative gene selection have been proposed. These have been tested using two cancer gene expression datasets retrieved from the Kent Ridge Bio-medical Dataset Repository. It has been observed that genes selected by the suggested algorithms yield better classification accuracies.

Knowledge based Elucidation of tertiary structure of proteins on their function: We have developed an algorithm to identify and predict ligand-binding sites in bacterial lipoproteins. The method uses three types of descriptors: fpocket descriptors, 3D Zernike descriptors and shell descriptors, with Support Vector Machine (SVM) for classification. To improve classification performance, WEKA-InfoGain feature selection is applied. Maximum 10 fold cross-validation accuracy of 86.83% is obtained while selected model achieved Matthews Correlation Coefficient (MCC) of 0.534.

Folding dynamics using parallel implementation of Wang Landau Algorithm: C-DAC has implemented the dynamics of self avoiding walk (SAW) and bond fluctuation model (BFM) in both two and three dimensions to study polymer dynamics. This dynamics has been incorporated in the original implementation of Wang Landau Algorithm. The effect of confinement and macromolecular crowding play a major role in the protein folding dynamics. The folding dynamics of the HP model [Hydrophobic Polar model] would be studied with this implementation.

Saptarang- Multi-Model Data Portal for Weather, Climate and Environment: "Saptarang", an online data portal was developed by C-DAC which hosts a range of simulated model output of meteorology, oceanography and air quality with huge database system. http://saptarang.cdac.in/

Kaalavastha: Developed a web based portal (Kaalavastha) to provide weather prediction for Kerala State Planning Board (KSPB) which will help them for planning and management of various agricultural activities. The portal gives weather information of next three days for the Agro ecological units of all the districts of Kerala state.http://rtws.cdac.in/kaalavastha/

Data Assimilation in Real Time Weather forecasting System: To analyze the impact of assimilation in the meso-scale short-range weather forecast and hence to improve the real time forecast accuracy, an attempt has been made for conducting WRF experiments with and without all the available observational data during the summer monsoon period of 2011 using 3d-variational data assimilation (3D-VAR). The comparison with observations showed that assimilation experiment with ingesting all available data (3DVAR) has shown substantial improvement in the model-predicted lower atmospheric parameters and rainfall pattern as compared to base experiment without ingesting any data. Simulations were carried out using 1024 processors of Param Yuva.

Seasonal forecast: Extended range prediction of Indian summer monsoon (ISM) using a high resolution National Center for Environmental Prediction (NCEP) T170/L42 global model using ensemble members has been operational from the year 2005 onwards. The seasonal monsoon forecast of the year 2011 is shared with Indian Meteorological Department as a part of India's official monsoon forecast.

Coupled modelling system: Regional atmospheric ocean coupled model strategy using Weather Research and Forecast (WRF) and Regional Ocean Modeling System (ROMS) developed at C-DAC under sponsorship of Department of Science and Technology, Government of India in collaboration with IITM to study air-sea interactions and its performance over Indian Summer Monsoon (ISM) region. The two-way coupled model exchanges heat fluxes from the atmosphere to the ocean model and the SST from the ocean to the atmospheric model in real time. From South west monsoon 2012 onward we are planning to give operational forecast.

Velocity Model Building using Full Waveform Inversion: Good estimate of velocities is the key factor for successful depth domain imaging. Also, it has been proved that Full Waveform Inversion (FWI) is a very good method of estimating elastic properties of earth. In areas where well data is absent or very less well coverage is available, FWI is used to synthesize 1D well response by modeling P wave velocity (Vp), S wave velocity (Vs) and Density (Rho). But due to its compute requirements it was earlier not possible to use it as a velocity model building tool. With the advent of new age parallel computers and programming paradigms, it is now possible to run FWI on number of CDP locations to get reliable 2D and 3D velocity models, including properties like Vs and Rho using seismic data, in a reasonably less time. An algorithm has been developed and it has been optimized on PARAM Yuva.

Comparison of rapid grid characteristic modeling algorithm with finite difference based travel-time generation algorithm: Travel-time is the time taken by seismic wave to travel from source to receiver or between two points. Travel-time calculations have direct application in oil industry. In the present attempt, we are carrying out comparison of algorithms developed on the basis of two different theories. The output of finite difference based travel-time generating algorithm is first arrival travel-time. The output of rapid grid characteristic modeling algorithm contains the information about velocity and stress in every grid point of medium at every time. So it is possible to calculate first arrival travel-time of P-wave. The comparison can be carried out by using same synthetic sub-surface P wave velocity model and the same source of signal as input for both algorithms and then comparing the first arrival travel-time generated.

Whole genome phylogeny of Mycobacteria: Whole Genome alignments can identify evolutionary changes in the DNA by aligning homologous regions of sequence within species and provides the data needed to characterize rates and patterns of genome evolution, in turn paving the way for diagnostics. In this study, we use an approach based on whole genome alignment using "MAUVE" and subsequently study their phylogenetic trends using Randomized accelerated maximum likelihood.

Salmonella biomarker identification: Identification of species-specific biomarkers eases the process for epidemiologic surveillance and can be readily used by molecular methods, such as multiplex PCR, real-time PCR, DNA microarrays and amplified fragment length polymorphisms. This study is aimed towards the identification of such species-specific biomarkers amongst 16 Salmonella spp. along with specific primers which can be used in the development of detection kits. Methodology involves identification of species-specific proteins using in-house developed comparative genomics package, viz., GENOPIPE followed by verification of mis-annotations, pseudogenes and horizontal transfer events.

Misfolding studies: Various neurodegenerative disorders are caused by the aggregation of misfolded naturally occurring proteins. Alzheimer's is one such disease caused due to the accumulation of Amyloid Beta (Aß) protein in the neuronal cells. Aß is a 42 residue long protein which is resultant of the cleavage of the Amyloid precursor protein (APP). Aß-42 is an alpha helical protein which on misfolding forms beta-sheet aggregates with multiple Aß peptides. These aggregates are formed in the neuronal cells due to which there is a lack of communication between them leading to Alzheimer's. APP is a membrane protein and the Aß portion of this protein lies in the membrane when it is correctly folded. The group performs simulations on Aß-42 in membrane and explicit water environment targeting to study the aggregation process.

Membrane Simulations ß2-AR Oligomerization Study: ß2 adrenergic receptor (AR), an important human G protein coupled receptor (GPCR) molecule with known pharmacological importance undergoes constitutive self-aggregation in lipid membranes. This oligomerization property has got immense pharmacological significance. Experimental studies have proved that ß2-AR undergoes constitutive oligomerization, but the structural mechanism is not known. To understand the mechanism of self-assembly, simulations of ß2-AR was carried out using coarse grained molecular dynamics (CGMD) technique with MARTINI force-filed. 10 µs CGMD run was completed on 16 monomers of ß2-AR in DSPC bilayer using GROMACS package on PARAM-Yuva. Analysis was done for the 10 µs trajectory. The CG model was also converted back to all-atom definition and simulated annealing was performed on the entire structure in order to identify the dimerization surfaces.

P53 -Transcription factor: p53, is a signaling protein which is involved in the cell cycle and is one of the hot targets for developing cancer therapeutics. It is a tetrameric protein, which has been studied structurally using crystallography. It performs the function of apoptosis and cell cycle arrest of cancerous cells by binding to their DNA. The simulations were performed on 16 cores of PARAM Yuva and 60 cores of BioChrome.

RAS protein: RAS pathway is one of the most crucial pathways of humans, the malfunctioning of which leads to oncogenic state and ultimately cancer. This cell-proliferation pathway involves many proteins including Ras (GTPase), various serine/threonine kinase like RAF,MEK,MAPK etc. As any alteration of this pathway leads to an uncontrolled cell growth, the study of the dynamics using MD simulations of Ras mutation can throw more light on structural changes leading to instability of this protein, ultimately resulting into cancerous state. An overall simulation time of 260ns has been achieved. The analysis have also been performed for these simulations. The simulations are being run on 16 cores on Param Yuva and 12 cores of Biochrome.

Development of Molecular Dynamics Code: This project aims to develop Molecular Dynamics (MD) code from scratch for large biomolecular simulations to reach target time scale. The broad plan is to design and develop this code such that it will tune to

modern hardware and scale efficiently on future HPC environment. Under this project thorough study of different aspects of molecular dynamics has been done. Starting part of project includes designing of the whole flowchart of MD algorithm in terms of various modules.

Joint Collaborative Research on Computational Aspects of Numerical Weather Prediction at NCMRWF, Noida and C-DAC

C-DAC has realised a huge potential for research and development in weather domain. The joint initiatives by C-DAC and NCMRWF, Noida have led to the development and porting activities of weather models in PARAM Supercomputers. Open source parallel computing software and tools have significantly accelerated the pace of the research work.

High Performance Computer Cluster for National Physical Laboratory, New Delhi

A centralized High Performance Computing Cluster has been established. This will be utilized for carrying out research activities in the scientific divisions: Physics of Energy Harvesting, Materials Physics & Engineering, Radio & Atmospheric Sciences, Time Frequency & Electrical Standards, Apex Level Standards & Industrial Metrology, Quantum Phenomena & Applications, and Sophisticated and Analytical Instruments. This facility will help to strengthen and advance physics-based research and development for the overall development of science and technology in the country.

Consultancy for setting up of Advanced Computing Centre at NETRA, NTPC, Greater Noida

The High Performance Computing Ecosystem at NTPC-NETRA will focus on carrying research activities in the field of Computational Fluid Dynamics, Finite Element Modelling/Analysis, Mathematical Modelling, Solar Energy, Wind Energy, Metallurgy and Development of virtual prototypes through rigorous practice of control system engineering.

Grid Computing

Grid Technology Services for Operational Phase of GARUDA

GARUDA Grid is at the forefront of activity in delivering technology services for operational phase of the Indian National Grid Computing Initiative. The objectives of GARUDA Operational Phase have been delivered/accomplished with timeliness, high quality of products, and large partner satisfaction. GARUDA has expanded to include a total of 65 partnering institutes spanning R&D organizations and academic institutes, aggregating 70TF-15TB compute-storage power. All partnering institutes are connected via the National Knowledge Network. GARUDA affiliation crossed 850 users from various domains. The users belong to 14 Virtual Organizations such as Bioinformatics, Computer Aided Engineering, OSDD, etc. The Open Source Drug Discovery (OSDD) community has been the largest user of GARUDA grid; over 70 users have successfully run 3500+ jobs consuming about 4500 CPU hours.

GARUDA has established a stable grid computing environment including middleware, tools and applications. Following middleware and tools have been released so far, to the GARUDA users:

- **GARUDA Access Portal (GAP)** – web based portal for access to the grid and its services including Job Submission, Job Status tracking, Storing / Viewing Executables/ Output/Error files. GAP **2.1** offering login service, compilation service, Storage Resource Manager, resubmission and status checking of jobs via SMS has been released.
- **Compiler Service** – provides an easy to use GUI based generic compilation facility hiding the complexities of the heterogeneous platforms in Grid.
- **Short Lived Certificate (SLC)** - provides users with instant access to GARUDA Grid for a limited period to get a quick understanding and first hand feel of grid computing.

Other facilities in Garuda include the following:

- **GUIftp** – Transfer of large data sets has been enabled in GARUDA using Globus Gridftp service.
- **QoS** – Quality of Service has been guaranteed with respect to availability of compute resources in GARUDA grid. This is based on a facility for **advance reservation** of resources in the GARUDA resource pool.

- **GVGHub** – GARUDA Visualization Gateway based on HubZero has been enabled for remote scientific visualization for various scientific domains. Various tools like GNUPlot, Rasmol, GrADs etc. have been provisioned in this gateway. The output from grid execution will be sent to the GVGHub for visualization by users.
- **PSE4PSP** – is a problem solving environment for predicting the 3-D structure of a protein from its amino acid sequence; a very useful tool for bioinformatics.
- **AGSG** – a web based tool to automatically convert executables as Grid (Globus) services to enable applications on the SOA grid.
- **Paryavekshanam** – Enhanced monitoring of various GARUDA resources across the geographically distributed locations is provided in this grid monitoring tool.

During the last year, a number of enhancements to the underlying framework have been done including new version of GSRM offering global namespace, storage accounting and VOMS authentication; new web based interface for Garuda administrators; and integration of various tools including GVG Hub, GSRM, Paryavekshanam and GAP.

Computational Global Atmosphere/Ocean modelling applications research

The Indian summer monsoon is a manifestation of complex interactions between land, ocean and atmosphere and the simulation of its mean pattern and its variability on inter-annual scales is one of the challenging problems in climate studies. The correct prediction of this complex phenomenon is vital to national planning and economic policy making. But despite the major advances in atmospheric sciences, simulation and prediction of the Indian summer monsoon remains a serious challenge.

This project leverages on the expertise gained from the DST sponsored project on 'Seasonal Prediction of Indian Monsoon (SPIM)' with the objective of taking it to the next level of application demand envisaged in the domain. SPIM project dealt with application of Atmosphere general circulation models for seasonal forecasting of Indian Monsoon. It is envisaged that coupled land-ocean-atmosphere models which have more comprehensive representation of climate system are needed for better prediction of Indian summer monsoon. It is expected that the outcome of the project will lead to further sponsored project under the National mission on monsoon.

Applications on Grid

Modeling environment for Coupled WRF-STEM:

Development of the grid enabled modeling environment for Coupled WRF-STEM on Garuda Grid for the simulation of atmospheric transport of aerosols and nano particles. Completed simulation of WRF-STEM for the year 2006 using different emissions provided by IIT Bombay using multi processors on Param Yuva.

Grid based PSE for Seismic UNIX:

Seismic Applications under Grid Garuda project includes a portal for generating and executing work-flow using seismic unix commands. Following modules has been added in PSE. Suedit - examine segy diskfiles headers, Susynlv - SYNthetic seismograms for Linear Velocity function; Rayt2d - Traveltime Tables calculated by 2D paraxial RAY tracing, Sukdmig2d : Kirchhoff Depth Migration of 2D poststack/prestack data; Sunmo - NMO for an arbitrary velocity function of time and CDP; Model : GUI is made for the Model module for the user to select velocity model; and Unif2 - Generate a 2-D UNIFormly sampled velocity profile from a layered model.

Computational Fluid Dynamics:

OpenFOAM CFD solver has been installed and implemented on the Garuda grid environment to enable CFD computation. The solver has been installed on gg-blr, gg-hyd and gg-che clusters and it is available for use through gridfs. CFD simulations have been performed using gridfs to test the installation and its usability. OpenSees is made available across all the clusters in grid garuda. Examples are successfully executed using command line job submission method, Web portal also using AGSG tool. Simple examples for the users who are new to OpenSees as well as Grid Architecture are made available to users.

Parallel Post-Stack and Pre-Stack Kirchhoff 3D Depth Migration:

The main objective of the present work is to study various depth migration algorithms and to develop an efficient 3D Kirchhoff depth migration scheme for both post and pre-stack seismic data. The depth migration is very expensive. To reduce the cost, we will parallelize the algorithm using MPI libraries on PARAM series of supercomputer along with a user interface. The MPI based parallel program can be easily ported to any parallel processing environment. To make the software user friendly, the Graphical Interface tools for input and output data would also be developed.

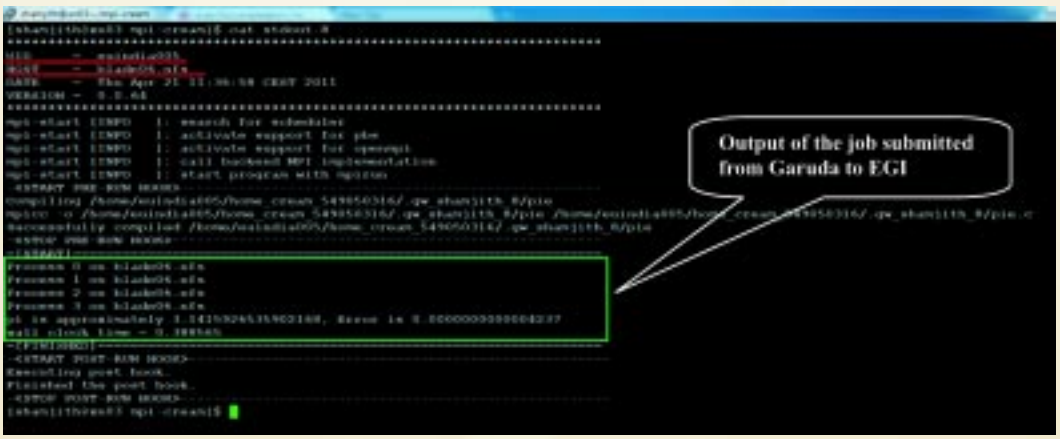
Migration Graphical User Interface

EU-India Grid2 Project

This project has been initiated to address job interoperability between Garuda and European Grid Infrastructure (EGI). The open source meta-scheduler Gridway has been chosen to facilitate the job submission across Garuda and EGI. Network connectivity and security interoperability has been established across Garuda and EGI resources. Configuring Middleware Access Drivers (MAD) for sharing Information and transferring data is complete.

EU-India resources viewed from Garuda

RegCM4 application has been demonstrated on this setup. New modules have been developed in Gridway meta-scheduler for supporting MPI specific parameters (WHOLE_NODES, HOST_NUMBER, SMP_GRANULARITY) for CREAM-CE environment.



Output of the job submitted from Garuda to EGI

Cloud Computing

A project has been initiated to build a pan-CDAC cloud system.
The main objectives of the project are:

- To develop Cloud Computing Framework including the middleware, for offering Software as Service (SaaS), Platform as Service (PaaS), and Infrastructure as Service (IaaS)
- To migrate/build teaching/learning frameworks on the cloud for use in C-DAC courses.
- To migrate select C-DAC courses to the cloud environment.
- To explore use of cloud environment for applications in areas of scientiic computing, SME/e-governance, health, etc.

Pan C-DAC Cloud – Middleware Development

Free & Open Source Cloud stack named Meghdoot, has been developed. The cloud stack features a Private cloud offering platform and infrastructure as a service (PaaS and IaaS), On demand dynamic provisioning, Metering & Monitoring, Graphical Installation component of Middleware, Web based Management of Cloud resources, one single middleware bundle that incorporates all pre-requisites, and APIs for easy deployment of multi instance user appliances

A number of value additions to Open Source tools in the cloud stack has been done which include Elasticity component integrated with Eucalyptus (this feature was available only in the commercial edition), Provision for hosting windows instances, High Availability to the cloud environment, Web Service Interface for management of Cloud, Web Application Firewall, Provision for deploying user licensed software, Metering and billing solutions, Self servicing portal, Graphical interface for ease of installation and configuration, and Provision for users to directly deploy their application and database.

A pilot test bed has been established at Tamil Nadu state data centre and also at CDAC Chennai.

C-DAC Scientific Cloud

Scientific cloud is a model for on-demand access to a shared pool of HPC resources (e.g., networks, servers, storage, applications that can be easily provisioned as and when needed by the researchers and scientists. Computational facilities can make use of cloud computing mechanism to create HPC platforms to meet the urgent demands of the scientists and engineers.
C-DAC scientific cloud aims to provide the following as HPC as a Service (HPCaaS)

- On Click provisioning of commodity servers
- Secure and quick access to MPI and Map reduce clusters to support compute intensive and data intensive applications.
- Storage as an Service (CloudVault): on demand provisioning of storage for storing any kind of files. Users will be able to access CloudVault through web browser, mobile application, and desktop application.
- Problem solving environments with respect to the Bioinformatics and Climate Modelling applications.

LANGUAGE COMPUTING

Embedding Indian Language Support

- C-DAC has bagged an order for enabling Indian languages on Android based Tablet. This technology was provided to Ministry of Rural Development, Govt. of India for economic survey of Below Poverty Line (BPL) families. Development and distribution license delivered and deployed on 6 Lac tablets. The “GIST android SDK” is compatible with latest Unicode version and supports 15 Indian languages. This tablet is used for census data collection in Indian languages across all over India.

- Successful integration of 10 Indian languages in Thermal printer completed for a Japanese client. This printer is available in the market and is used for receipt printing. This thermal printer solution supports ISCII, Unicode, UTF, TAB and TAM encodings. The solution also includes 48 bitmap fonts aesthetically designed and highly customized for thermal printing technology.

- C-DAC has bagged an order for enabling Greek and Bengali support for product range for mobile handsets to be launched in Bangladesh. The solution includes customized Bengali language stack with customized font designed for menu and SMS editor.

Unicode Typing Tool

It is a single package of keyboards in the following 26 Indian Languages (including Perso Arabic) along with the fonts: Assamese, Bangla, Boro, Dogri, Gujarati, Hindi, Kannada, Kashmiri (Devanagari Script), Kashmiri (Perso Arabic Script), Konkani, Malayalam, Manipuri (Bengali Script), Manipuri (Meetei-Mayek Script), Marathi, Maithili, Nepali, Odia, Punjabi, Santali (Devanagari Script), Santali (OL-CHIKI Script), Sanskrit, Sindhi (Devanagari Script), Sindhi (Perso Arabic), Tamil, Telugu and Urdu

JavaScript Based Floating Keyboard

To provide zero download solution for Indian Language typing for web based applications, JavaScript based floating keyboards have been designed. Keyboards are based on language arrays. Language arrays are easily updatable as per requirements. With this facility user can type using INSCRIPT layout on any Unicode enabled web-page. Keyboards are designed to provide switching between Indian languages to English as per requirement. Keyboard is freely floatable on webpage, hence does not affect existing developed web pages on integration. Keyboard supports Unicode 5.2 standard characters.

GOI Search Engine

C-DAC along with Persistent Systems Pvt. Ltd. is working on a project called "Government of India" search engine. The aim is to develop and deploy a scalable search platform specific to the needs of all government websites hosted by NIC. Major open source tools/technologies like Nutch, Solr, Hadoop etc. will be used to build the search platform. Initially search engine will support English and Hindi language.

The Search Platform will be enabling users to easily and quickly find pertinent State information in the areas of Government, Executive, Judiciary, Legislature and Institutions such as Banking, Educational, Healthcare, Research, International Missions abroad, Tourism, Sports and other Government or Semi-Government organizations and Committees & Commissions. It will also enable internal users from various departments to improve searchability on information spread across various websites and content management silos.

As a POC, Search as a Service is enabled on Prime Minister's official website: http://pmindia.gov.in

Intelligent Script Manager

Intelligent Script Manager family of products from C-DAC underwent several updates and customizations. it supports 19 Indian languages: Assamese, Bengali, Gujarati, Hindi, Kannada, Marathi, Malayalam,Oriya, Punjabi, Sanskrit, Tamil, Telugu, Manipuri, Nepali,Konkani, Bodo, Santhali, Maithili, Dogri, in addition to Roman English. ISM now supports 64 bit applications, switching automatically its mode for 32 bit application or 64bit application at run time.

Intelligent script manager is also now compatible with frequently used applications including MS Office(64bit & 32bit), Open office 3.0, Internet Explorer, Mozilla Firefox, Libre Office(3.4).

64bit Enabling of Tahreer

TAHREER gives freedom to the user for creating content, letters and documents in the Perso Arabic script. These scripts are Right to Left by nature. Languages based on these scripts, viz., Urdu, Sindhi and Kashmiri, are among the official languages of India. TAHREER is capable of handling Right to Left scripts on any UNICODE compliant application, such as - Notepad, MS-Word, etc. It is compatible with 64bit and 32 bit operating systems. Using Tahreer along with any Unicode enabled web-content creation tool, user can create HTML documents which can be published on the Web. Different layouts (INSCRIPT/ PHONETIC/ CUSTOM) are supported. The tool also comes with a Virtual Onscreen Floating keyboard.

NE Spellchecker

Spell checker is now available for Northeast languages: Assamese, Bodo, Manipuri, and Nepali. Its a OO macro independent of ISM .Spell Checker points out possible spelling errors in documents . The utility also provides suggestions for correcting the error word.

Heritage language Pack

Supports Vedic-Sanskrit, Modi, Grantha, Ol-chiki, Meetei-meyek, and Limbu. These languages are apart from the 22 official languages for which basic information processing kits have already been made available by C-DAC. The software pack contains a highly calligraphic font and Unicode enabled keyboard driver for each of the languages.

iSuggest with ISM

iSuggest is a keyboard type which phonetically transliterates a word into multiple intelligent suggestions. When user is typing with iSuggest Keyboard type, user can alter a typed word by selecting one of the suggestions in the iSuggest notifier list. iSuggest generates Intelligent suggestions based on different phonetic pronunciation, number to text conversion, abbreviation like ICICI, forward and reverse splitting of long English words like BharatBhasha, SMS/chat terms like 2moro for tomorrow, words with spelling difference like Localise and Localize, etc. It makes iteasy for the user to type in Indian languages over web.

iPlugin Support for web browsers

Google Chrome has over 33% worldwide usage share of web browsers, making it the most widely used web browser across the globe. So there is increased trend of Internet users adopting Google Chrome browser. A solution is provided by iPlugin to support Google Chrome browser as extension/add-on for end user and added feature for iPlugin product. Now with feature of iPlugin add-on, end users can use Indian languages for web based iPlugin enabled application running in form of websites on Google Chrome browser. iPlugin now also supports 64 bit Internet Explorer.

PAN CARD Intimation letters in Hindi

C-DAC has successfully developed and deployed a customized transliteration and translation solution for the PAN India Data of Income Tax Dept. On a daily basis, the Income Tax Dept processes approx. one lac applications for issue of new PAN cards and dispatches the intimation letters for these along with the PAN card. The names and address fields in the intimation letters are translated on the fly in Hindi. C-DAC solution is currently being used for the same.

IDN – Internationalised Domain Names

C-DAC has been involved in Internationalised domain names along with DIT and NIXI (National Internet Exchange of India). Under this initiative C-DAC is assisting NIXI in integrating the GIST-IDN-Validation-Engine and GIST-IDN-Variant-Generation API for supporting Indian language domain names. Currently Hindi, Marathi, Konkani, Nepali, Sindhi-Devanagari, Bodo, Dogri and Maithili are under integration with the registry.

PERSO ARABIC SUITE

This is a wide set of tools, technology and products for Perso Arabic scripts. Languages based on these scripts, viz., Urdu, Sindhi and Kashmiri are among the official languages of India. C-DAC has done extensive research and development in the areas of Font, Cursor Movements(bi-di) rendering on Desktop, Web and Mobile Devices, development of Synonyms, Spellcheckers, Dictionaries, Thesauri, Localisation tools, Prediction Algorithms, Search Engine plugins, Transliteration and Machine Assisted Translation technologies for Urdu, Sindhi and Kashmiri.

Fonts and Tughras

Highly calligraphic Nastaliq and Naskh scripts Fonts have been designed and developed in Open Type Format . This is written in two scripts : Naskh & Nastaliq, and are written Right to Left. In these scripts, letters join with one another in running form, and shape varies depending on whether the character is in the middle of a word, at the start, at the end or standing alone

Trjumahkaar

This is a Machine Assisted Translation tool which converts Urdu to Hindi. It gives user a list of suggestions for every typical Hindi, translated word, from which user can select and replace the selected word. It supports PASCII as well as UNICODE Standards.

Transliteration

Transliteration tools are now available for various language pairs such as Hindi-Urdu, Punjabi-Shahmukhi, Telugu-Urdu, Kannada-Urdu, Gujarati-Urdu, Bangla-Urdu, English-Urdu and Urdu-English. Work is currently ongoing for other language pairs. These

engines are used widely in transliterating names for various e-governance applications. Transliteration engines are used widely in data entry and printing localised reports.

Indian Language Computing Initiative- National Roll Out Plan Phase-II

As next step in helping the end users in using the free language CD, we have established a technical support call centre where people from across the country (India) can call on toll free number 1800-209-1015 and team at back end will help them. The support call centre is currently available in Punjabi, Tamil, Telugu, Hindi, Marathi, Gujarati, Malayalam, Bengali, Malayalam and Sindhi languages.

Translation Memory Creation Tool

This utility is developed for creating translation memories from free & open-source software. It takes a GNU Portable Object (PO) File as input and builds the translation memory database after extracting translation from input file(s). This allows one to use it in future for fulfilling localization & translation requirements.

Establishment of Indian language Technology Proliferation & Deployment Centre

Following major enhancements have been added to this portal during the year

A) Common UI for MT (Machine Translation) System: Unified User Interface among the MT systems for TDIL-DC has been completed. Web based translation service are available in three modules: Sampark (Indian to Indian Languages - Punjabi to Hindi, Hindi to Punjabi, Telugu to Tamil, Urdu to Hindi, Tamil to Hindi, Hindi to Telugu); AnglaMT (English to Bengali, Malayalam, Punjabi and Urdu) and Anvadaksh (English to Hindi, Bengali, Marathi, Oriya, Urdu and Tamil).

B) Consortia Workspace: A web-based application with facility of sharing consortia project resources to facilitate online collaboration, with centralised management of resources. It also provides permission manager for resource sharing, i.e. diff. roles with different permissions for PRSG member, consortia member, consortia Leader, upload of documents and schedule meeting with auto email notification. It will keep everyone updated with the ongoing project developments.

Corpus Analytix for Analysis of Text Corpora

Corpus Analytix is a tool developed by C-DAC, for analyzing and correcting text corpora. This tool has a built-in concordance that can be used to analyze the text. It can find all occurrences of a raw string, as well as find all occurrences of a given pattern like an adjective followed by a noun. Regular expressions can also be used for finding raw strings. The tool also allows the user to do spell-check and grammar-check of the text, provided the dictionaries are available for the given language, in the desired format. The Find/ Replace facility that is provided, can work alongside the concordance to ensure that a wrong word is corrected consistently wherever it occurs in the corpora. The tool provides the option of getting the Part-Of-Speech of a given text. It can also lemmatize a given word. Currently, the grammar-checker is available for Hindi in Beta version. All-in-all, the Corpus Analytix is an integration of the various Natural-Language-Processing tools, which can be used by linguists working with corpora.

MarathiVishwakosh.in

C-DAC has successfully developed and deployed Digitization of Marathi Vishwakosh. Marathi Vishwakosh is an encyclopedia in UNICODE for Marathi language. Marathi Vishwakosh contains 18 volumes (each volume contains about 1000 pages).

Marathi Vishwakosh website currently has more than 2.75 lacs visitors and daily around 900 hits from all over the world. Developed fonts including symbol font to support symbols and formulas. These fonts are embedded in Marathi vishwakosh to support all browsers. Marathi vishwakosh supports searching both in Marathi and English. It also has auto suggestion feature. Marathi vishwakosh is compatible with all latest desktop and handheld devices including Ipad, Iphone, and Android based devices.

Shri Privithiraj Chavan, Minister of Information Technology, Govt. of Maharashtra released the digital version of the 1st Volume of the Marathi Vishwakosh at Mumbai on 25th October 2011. Padmashree Dr. Vijay Bhatkar released the 2nd Volume of the digital Marathi Vishwakosh at Pune on 30th November 2011.

Shri Kateekal Sankaranarayanan, H. E. the Governor of Maharahstra, released the digital version of the 3rd Volume of the Marathi Vishwakosh at Mumbai on 3rd January 2012. Hon'ble Minister of Information Technology, Govt. of Maharashtra, Shri Privithiraj Chavan released the digital version of the 4th and 5th Volume of the Marathi Vishwakosh at Mumbai on 27th February, 2012. Padma Vibhushan, Shri Anil Kakodkar released the digital version of the 6th Volume of the Marathi Vishwakosh at Mumbai on 31st March, 2012.

Maharashtra Sahitya and Sanskriti (Digitize the contents of Literature and Books)

The basic aim of this project is to digitize the contents of literature and books in the form of eBook . All efforts have been made to ensure that these can be read on all media; in some cases where there exists no possible support for Indian languages or in some devices where the rules of composition of Indian languages are not properly complied with, there could be difficulty in reading the contents. The e-books will be made available in the three most popular open standards formats: .Epub , .Mobi and .Pdf

Testing & QA for Indian Language Applications

Testing has been done for following applications hosted on TDIL-DC; UTRRS, Web OCR (Hindi & Punjabi), Online Sanskrit tools, Updated machine translation system, and CLDR (Common Data Locale Repository).

Testing of TTS Consortia systems done for 6 Indian Languages Bangla, Hindi, Marathi, Tamil, Telugu and Malayalam. The team visited the NABs from different states and visually challenged people from respective language backgrounds were used for evaluation of the systems.

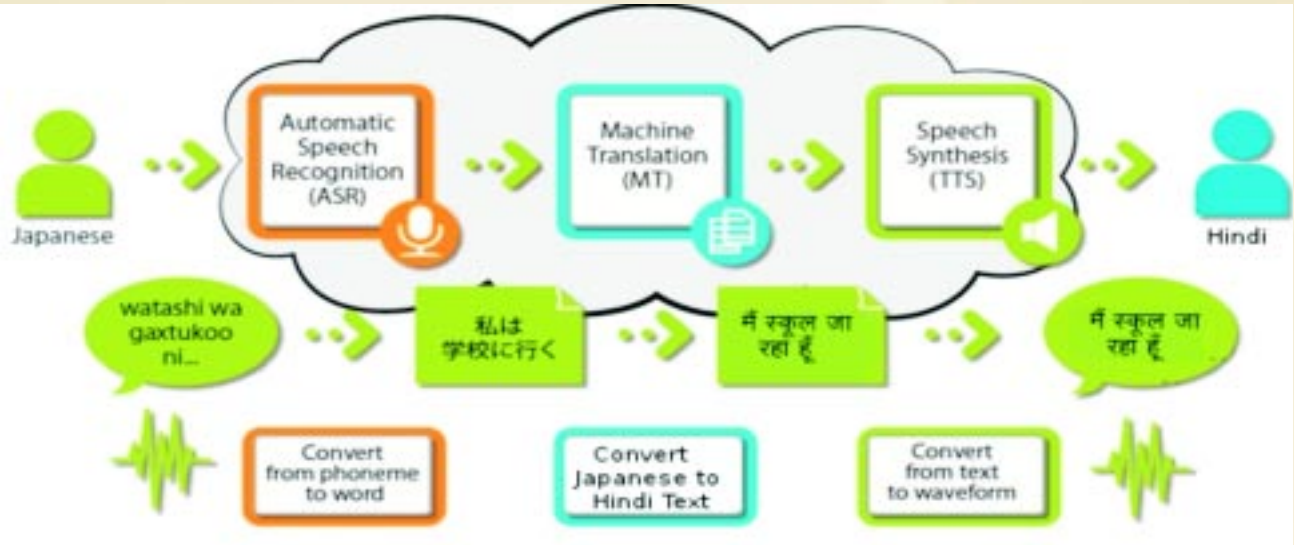
Dry run & testing of Automatic Speech Recognition systems (ASR) for 6 Indian Languages, Assamese, Bangla, Hindi, Marathi, Tamil, and Telugu was carried out.

Testing of Sanskrit2Hindi MT systems of consortia headed by University of Hyderabad was done.

Universal Speech Translation Advanced Research (U-STAR) Consortium project

The Universal Speech Translation Advanced Research Consortium (U-STAR) is an international research collaboration entity formed to develop a network-based speech-to-speech translation (S2ST) with the aim of breaking language barriers around the world and to implement vocal communication between different languages. The objective of the project is to initiate a speech to speech translation service among languages of participating countries.

The tasks involved are expanding the volume of speech and text corpora, standardization of corpora, communication protocols of modules and interface formats for three major modules of Automatic Speech Recognition (ASR), Machine Translation (MT) and Text to Speech Synthesis (TTS).



The current participating organizations are - NICT (Japan, coordinator), NLPR(China), ETRI(Korea), BPPT(Indonesia), NECTEC(Thailand), IOIT (Vietnam), CDAC(India), National Taiwan Univ. (Chinese Taipei), A-STAR (Singapore), LTK(Nepal), UCSC(Sri Lanka),MUST(Mongolia), NUM(Mongolia), DITT(Bhutan), UPD(Philippines), BME-TMIT (Hungary), ITDS (Germany), PJIIT(Poland), INESC-ID(Portugal), TUBITAK(Turkey), CNRS-LIMSI (France), BME-TMIT(Hungary), PJIIT(Poland), PPKE(Hungary), SpandH(England) and UUlm(Germany).

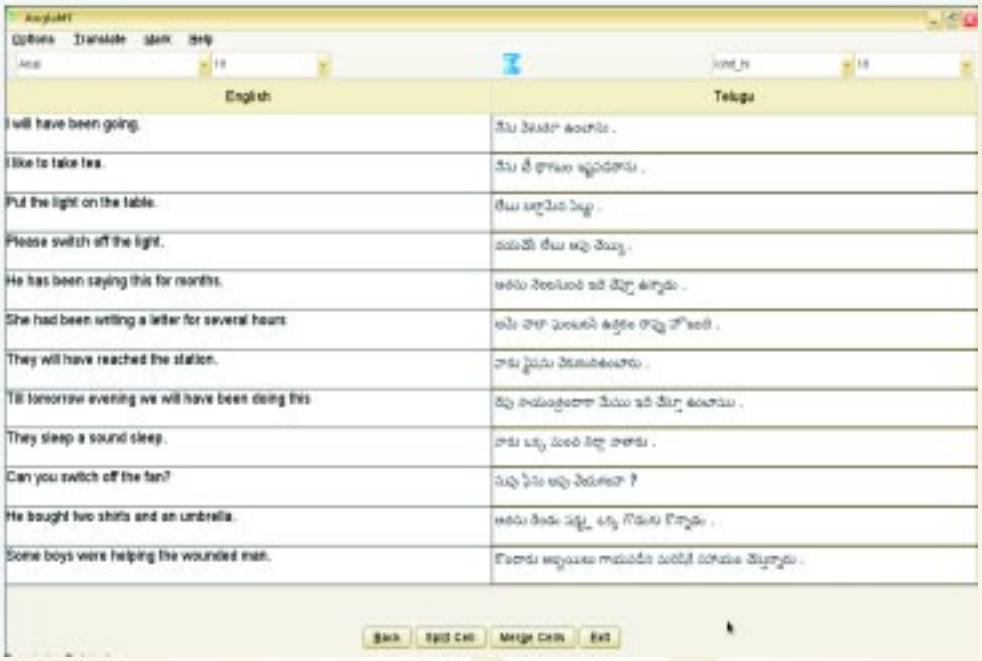
A live demonstration is planned during London Olympics, 2012.

Digital Library

C-DAC is involved in Digitization of Libraries as a mission mode activity under the aegis of the DeitY Initiative of Digital Library of India. After completing digitization of about 12 prestigious libraries, the free copyright contents of about 10 TB has been created and is in the process of getting uploaded on http://www.dli.ernet.in. A project for digitization of contents at Gujarat Vidyapith, Ahmedabad and Aligarh Muslim University, Aligarh has started, both eminent Universities with long history and their libraries have culturally rich contents of interest to many readers, researchers and students. The project envisages the conversion of these into digital form by a scanning, cleaning and indexing procedure. The output would be cleaned images of the content in digital form. A set of indices would be created onto these documents. Using these indices, it would be possible for a search engine to locate the various documents/books corresponding to a given index key-word.

English to Indian Language Machine Translation system based on Anglabharati Technology Phase II

The AnglaMT system aims to design, develop and deploy a machine translation (MT) system from English to Indian languages in tourism (travel) and health (pharmaceutical) domains. Indian languages targeted are Assamese, Bengali, Malayalam, Nepali, Punjabi, Telugu and Urdu. C-DAC is now working on adaptation of AnglaBharati Technology for Telugu and Assamese language. C-DAC has developed a lexicon entry tool which will help the user to convert target language lexicon file (English) into source language (Telugu) lexicon file. English-Assamese Lexicon entry started. SMS based Prototype development of MAT in Mobile devices is in progress. The first version of English to Assamese translation system is now ready.



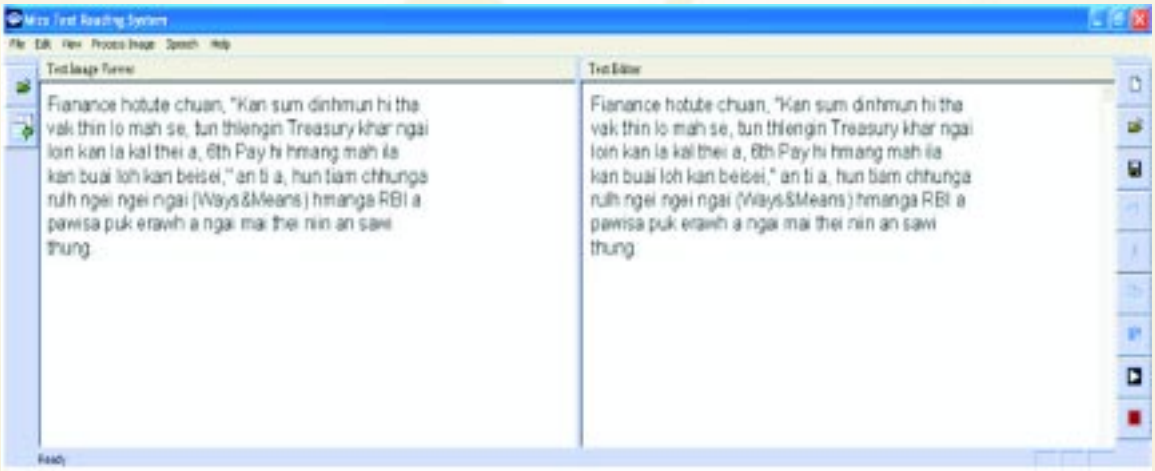
Text To Speech Systems for Indian Languages (TTS-IL)

Text To Speech Systems for Indian Languages (TTS-IL) is a consortium based project sponsored by the DeitY, Government of India. Primary goal of this project is to develop TTS systems for Indian languages (Hindi, Bengali, Marathi, Telugu, Tamil and Malayalam) using open source Festival Speech Synthesis engine. The Consortium is headed by IIT Madras and C-DAC Mumbai is primarily responsible for developing TTS for Marathi, and Malyalam.

Marathi TTS synthesis system is built with more than 10 hours of studio recorded speech data delivered by a competent female Marathi voice artist. Syllable based unit selection technique is used which gives more natural speech compared to the existing TTS in Indian languages till date. This is a big leap for visually challenged (VC) to get into the mainstream society. They are now able to computer-read Marathi Unicode text, learn basic uses of computer, send mails in Marathi, read Marathi websites, online newspapers, etc. This product was released in August 2011 after testing.

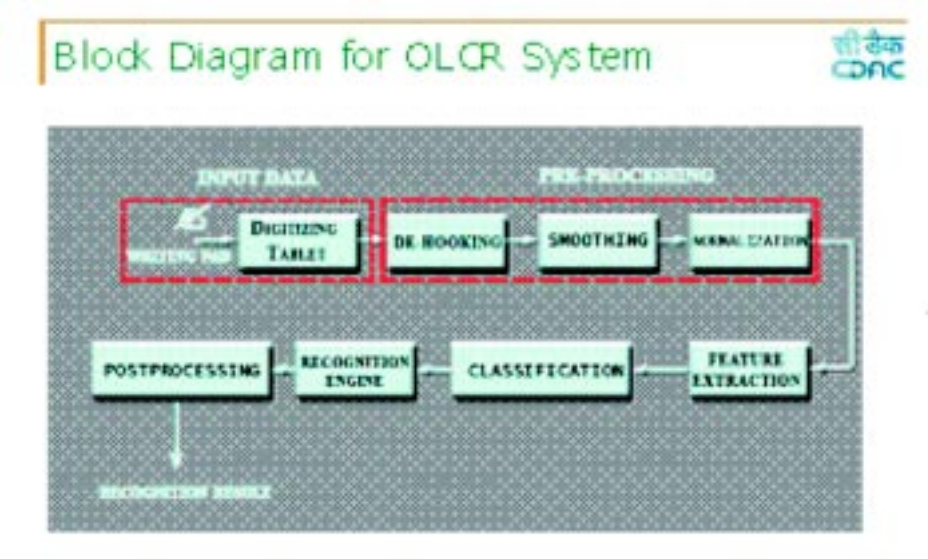
Speech-based Access for Agricultural Commodity Prices in Six Indian Languages (ASR Consortium project): The objective of the project is to implement and deploy a speech based system using which any user (especially farmers) can get prices of agricultural commodities by speaking over telephone or mobile. For this purpose, data has been collected from farmers in two phases, almost 2800 sets of farmer's speech data has been collected. One semi automatic transcription tool was developed for speech data transcription. Phonetic dictionary and Language Model were developed for the collected data. Using this data, one demonstrable system was built that can recognize and give price information corresponding to all districts and commodities of West Bengal. In-house testing, field testing and evaluation are going on for this project. This system has been demonstrated in 15th National Expo at Belgharia, Kolkata on September 2011.

Text Reading System in Mizo Language: The project aims to develope Mizo Text reading System for visually challenged people of Mizoram. A scanned Mizo-document will be fed to the Mizo-OCR system integrated with the Mizo Text-to-Speech Synthesis system for generating corresponding voice output in Mizo language.



Digital Library for North Eastern States: This project is in continuation of Digital Library of India Project to digitize the Rare and Copyright Free Books available in Eastern and North Eastern part of the country. As a part of this initiative, the scan centers in Tripura are working with the State Libraries and Archives in the states of Assam, Manipur and Tripura. The activity will spread to other North Eastern states by this year. The target is 10 Million pages by end of 2012.

Online Character Recognition System for Handheld Devices: Online handwriting recognition refers to machine recognition of handwriting captured in the form of pen trajectories. The system recognizes Malayalam Characters as and when they are hand-written on a Tablet or Touch Screen, with minimum number of constraints imposed on the writer. Current average recognition rate is 94% at character level and 82% at word level. The system uses a two-stage classification scheme using nearest neighbour classifier, with an option to train individual handwriting and create custom database. The system is Unicode compatible



Enabling Language Processing Inside Desktop Applications

In spite of significant advances in the development of NLP and associated frameworks, little progress has been made in enhancing existing end-user clients with text analysis capabilities. To overcome this gap between desktop environments and text analysis frameworks, An open service-oriented architecture has been developed, which makes it possible to easily incorporate an NLP service into a client application. This project also includes development and integration of specific NLP tools to demonstrate their usability with the desktop clients. Hence, Named Entity Recognizer (NER), Grammar Checker and Summarizer was developed for Hindi and demonstrate the integration of these services with OpenOffice.org, Firefox and Thunderbird. Design & development is in progress for NER tool and the framework for desktop NLP tools integration with applications

PROFESSIONAL ELECTRONICS

Tetra-WiMAX Base Station [TEMAX]

The objective of the project was to develop a Base Station conforming to TETRA and Mobile WiMAX standards, supporting Voice and Mobile Broadband Communications. The project was also aimed at gaining expertise in multi-standard base station development and making indigenous technology available to users/industry

A proto model of TETRA–WiMAX Base Station supporting Voice, Data and mobile Broadband Communications was developed and made available for demonstration to potential users.

Network components such as ASN gateway, Authentication and security system, gateways for protocol conversion/interoperability, DHCP/DNS system and Network Management and monitoring system for TETRA-WiMAX Base station were also developed.

The end product can be used as TETRA base station, WiMAX base station or as an integrated TETRA-WiMAX base station. Accordingly, the user terminals can be TETRA or WiMAX, as per requirement. TETRA is found to be the optimum communication solution for professional audio communication with limited data capability. WiMAX, on the other hand, is suitable for high throughput data communication over long distances. Hence the product can be used for a variety of applications such as audio and high throughput, long distance data/video communications.

Cognitive Radio Networks for Broadband Wireless access-Phase I

Need for communication is ever on the increase. The scarce resource, as far as wireless communication is concerned, is the radio spectrum. Cognitive radio technology enables more efficient use of the spectrum, thereby providing more communication channels to meet the growing demands of the society. Cognitive Radio (CR) is an emerging advanced radio technology that enables a radio device to monitor, sense, detect and autonomously adapt its communications channel access to the dynamic radio frequency (RF) environment in which it exists. The CR technology increases the efficiency of spectrum resource utilization through its flexible spectrum management techniques. The technology is an extension of software defined radio concept.

A Cognitive Radio system has three components: spectrum sensing, spectrum sharing and cognitive resource allocation. Spectrum sensing is done by a cognitive device to know if the spectrum is being used by another (primary or secondary) device. It is allowed to use the device only when the channel/spectrum is free. The design, implementation and validation of a Spectrum Sensing Engine (SSE), for detecting the presence of analog TV signal, is the major contribution of C-DAC in phase-1 of the project. The SSE comprises a COTS hardware platform running the spectrum sensing algorithm.

The system meets the false alarm/miss detection performance comfortably at -27 dB SNR for the given test conditions and the specified requirements of the SSE are complied with. This is a very encouraging result in the light of the performance requirements of spectrum sensing in cognitive radio standards such as the IEEE 802.22 WRAN. A feasibility report for Phase II was also generated based on the Phase-1 of the project.

Consultancy on study & Analysis of Existing policy based MANET Management Models

CDAC deployed a High Level Network Management (HLNM) System in the naval platforms after extensive study and analysis of various policy-based MANET Management Models. The study also proposed a software architecture and high level design, required for the existing HLNM system to cover Software Defined Radios and their management. The features include Policy Based MANET Management Model, Adaptive transmission rate adaption and power control for wireless transmission, QoS based packet scheduling and Queuing for transmissions and Dynamic TDMA to support slot loaning.

The algorithms developed can be used in other similar Mobile Ad-hoc Networks also. The development is of strategic importance as its deployment will lead to the effective utilization of Naval Communication Infrastructure.

Development of Simulation Platform

An Industrial Simulation Platform (iSimP), for teaching, developing and experimenting with Advanced Process Control Algorithms, has been developed by CDAC under the ASTeC programme. The objective of the project was to develop an Object Oriented Modeling and Simulation Platform conforming to international standards for the automation system envisaged under ASTeC.

Process models are widely used to simulate the real processes in today's modern plant automation and control systems, to learn the process behaviour during the normal operation of the plant and to design and test appropriate control strategies to improve the performance of the controllers. The accurate simulation model allows operators to train under "live" conditions without exposing the plant to the adverse consequences of their operational mistakes. iSimP has been developed to address these requirements with the technical know-how of Linkoping University, Sweden.

Development of Colour Sensor System

The Industrial Colour Sensing System (iCoss) is a handheld unit capable of identifying and measuring different colours. The system can be used for Reflective as well as Refractive materials by attaching interchangeable sensor modules.

Unlike the traditional Colour Sensors, which give only a “match/no-match” output condition, this system is designed with sophisticated and stable algorithms for outputting both RGB and CIE-L*a*b* values. The system finds many applications, especially in the Paper industries and Water Treatment Plants. This is one among a series of products that are being developed under the mission project ASTeC (Automation Systems Technology Centre).

Embedded Controllers and Common Communication Interface

Development of 3 types of controllers – Multi Loop Controller, General Purpose Controller, and Low Power Controller -- and a Communication Gateway have been completed.

- Multi Loop Controller offers 96*96*120mm DIN Panel Mountable Compact design; new Generation web based HMI Compatibility; single 24V Power supply operation; 5-bit Configurable and unique Module ID; embeds high performance 32-bit RISC Processor; and embedded Free RTOS.
- General Purpose Controller has real-time clock; Open Source embedded Linux OS with real time functionality; redundancy in power supply, CPU Module, Communication Controller Module, and Communication Link; hot swappable modules; Coldfire MCF5485 Processor from Freescale
- Low Power Controller is powered by ultra low power 16-bit MCU Active and low power modules for extended battery life (48 Hrs of battery backup) and embeds event based Tiny OS Scheduler for low power application.
- The communication gateway offers Modbus TCP master to DNP 3.0 Serial slave protocol conversion; DNP 3.0 TCP master to Modbus RTU Slave protocol conversion; Modbus TCP to RTU and DNP 3.0 TCP to serial protocol conversion; Product Configuration remotely via Ethernet or locally via USB; and Customised Linux BSP.

Flexible Open SCADA

C-DAC successfully developed Web-based SCADA software, which interfaces with the embedded controllers developed under ASTeC programme and also with third party systems, using open protocols such as Modbus TCP, DNP3 TCP, IEC 60870-5-104. The software also supports OPC DA 2.0 servers and PMUs. The product is named iROSE which consists of three packages – iFACE (Human Machine Interface), iROC (Configuration Software), and iDLog (Data logger).

iFACE Features include User Friendly GUI with Multiple Windows; User Authentication; Run/Configuration Mode; Object Property Align, Zoom Palettes; User defined Symbols, ISA Symbol Library; Standard Drawing tools; Online/Historic trend; Object Explorer; Alarm by SMS, email & Voice and Alarm Logging; Faceplates, Recipes, Scripting, Report, and Computed Tag

iROC Features include Area-wise controller configuration; Controller Configuration(iSmart/iCON/third party); I/O Module Configuration; Tag Configuration; Communication Configuration; GUI for Functional Block Programming using IEC 61131-3; Simulation of Control Logic; Display of Tag Values/setting of parameters on Control logic

iDLog Feature include scheduled Log, Periodic Log, and Log-on change; and Shift-wise Logging of data in database/files

APC Functionality

Advanced Control algorithms (Enhanced PID controller, Auto tuning PID controller, Gain scheduled PID controller, Fuzzy Logic controller and Model Predictive Controller) have been implemented, under the ASTeC programme, to address the requirements of the online control applications in industrial processes and systems. MIT (Madras Institute of Technology), the project partner institution, developed a set of Process Modeling tools and Advanced Control Algorithms and CDAC, being the implementing agency, ported, tested, incorporated and validated the control algorithms in the Automation System developed under the ASTeC Programme. APC functionality consists of embedded function blocks of Enhanced PID controller (EPID), Auto tuning PID Controller (APID), Gain Scheduled PID controller (GPID), Fuzzy Logic Controller (FLC), and Model Predictive Controller (MPC), which run in the controller along with the pre–built face plates for operation and monitoring through HMI. Complex algorithm involving more mathematical computations (FLC and MPC) are arranged in the form of external function blocks and run in the computer systems. Embedded–External system architecture used in the implementation makes it very easy for the user to engineer their application and also to eliminate the need for interfaces.

Advanced Control Algorithms developed in this project meets the requirements of most of the on-line advanced control applications encountered in industrial processes and systems. This advanced control capability helps to optimize the product yield and quality while minimizing consumption of energy and raw materials. Application areas include Process Industries, Power Plants and Metallurgical Industries.

Design and Development of a Reconfigurable MPSoC for Embedded System

The ERMPSoC system is a distributed memory multiprocessor system-on-chip. Each processor has its own private read-write memory. This memory is used for program, read-write memory, stack and heap. There is a dual-port, read-write common memory accessible to both the processors which is used to hold the input data, and common parameters. The ERMPSoC integrates two ER902 processor cores, 80KB instruction & data memory, 96KB common memory, UART interface, Flash interface and Timer unit. Dual core integration was done so as to obtain a speedup of more than 1.8 for jpeg encoder implemented on dual core when compared to that of single core.

This technology can be used to develop high performance embedded products in application areas like Graphics, Radio, Video, Imaging, Crypto etc.

Sub-10K PC

The SUB-10K PC is a custom-made PC which provides all the basic functional capabilities of a PC with standard hardware and software. The system consists of customized hardware and BIOS, with support for standard OS and application software. Platform consists of VIA C7-D 1.5 GHz processor and CN700/ VT8237R+ chipset. Application areas include Embedded Systems, Small Office/Home PC, Point-of-Sales terminals, thin clients, and Internet/web-based appliances. Robust hardware, customizable to meet target user requirements at an affordable cost, and consuming comparatively low power, is expected to give this product an edge in mass-targeted applications. The PC has a Micro-ATX form-factor motherboard with 4-layer PCB and other standard PC interfaces such as PCI, IDE, USB, SATA, Ethernet and COM ports.

Hazardous Object Removal System Phase 2

There are many occasions when it becomes necessary to remove a potentially hazardous object from an environment where it might cause harm to humans. It might be an explosive device planted in a market or airport or place of religious worship etc. by

terrorists. In such situations, it is desirable to have a remotely controlled mobile robotic device to go and pick up the object and move it out of harm's way, to avoid putting security personnel's life at risk.

There are three main components in a mobile hazardous object handling system;

- The remotely operated pick-up mechanism.
- The vehicle to carry the pick-up mechanism to the area of Operation.
- The man-machine interface for the remote operators controls.

The mobile can be controlled wirelessly over a range of 500m, and is capable of climbing a gradient of 1 in 1.7 and stairs. It can perform zero-radius turns and is compact enough to go through doors at airports and other public buildings. The system has 150Kgs payload capacity for mobile unit and has a grip force sensor for controlled gripping on object. The grippers are easily replaceable to suit various objects. It has ultrasound based obstacle avoidance system. The Indian Army / ISRO/ NSG/BARC have shown interest in the product.

Synchronized Phasor Measurement Unit for Power System Wide Area Measurements

Synchronized Phasor Measurement Unit, suitable for application in Power System Wide Area Measurements and an interface to SCADA system has been developed. The product finds applications in electrical substations, to monitor electrical parameters for real-time control of power systems.

The device is used to measure power system data in real time and report to the PDC (Phasor Data Concentrator) for visualization, data storage and most importantly for running a variety of `on line and `off line applications in system analysis and control. The key benefits are real-time monitoring and control of the power system and flexible communications. The PMU developed fits seamlessly into the existing network. This will enable the system to run economically and will ensure system stability following major disturbances. The unit has a sampling rate of 25.6 kHz, and GPS based synchronization and time stamping. Successfully conducted environmental testing at ERTL, Trivandrum.

2.0 MVAR STATCOM for IT Park, Trivandrum

C-DAC developed and deployed STATCOM solution for IT parks, by compensating neutral current, unbalance current, reactive current and harmonic current present in the load. C-DAC delivered four 500kVA STATCOMs and conducted field trial with two units. The 3rd unit was commissioned at Nila substation 2B, Technopark.

Sonic-Ultrasonic NDT System MK2-R3

SOUNDS is a System for Non Destructive Testing (NDT) and Evaluation of materials, using Sonic and Ultrasonic frequencies. Using SOUNDS, the user can measure the velocity of a sonic-ultrasonic wave through the test specimen, and the attenuation of the wave in the material, the values of which depend on the type and composition of the material. Two fully tested units have been delivered to the customer. The system supports frequency sweeping, digital filtering, relative mode measurement, and signal data archival.

Non-contact Vibration Analyser

Vibration measurement of machinery, structures, electronic assemblies etc. is a widely used health monitoring, and failure prediction technique. In Non-destructive impact testing, vibration measurement is used for material characterization and structural integrity testing. The most widely used vibration sensors are accelerometer based. In this, the sensor has to be in contact with vibrating surface. The primary disadvantage of this method is that since the sensor is touching the vibrating surface, the mass of the sensor may affect the resonance characteristics of the vibrating surface.

The equipments available currently for non contact vibration measurements are based on Laser techniques and are very costly and bulky. C-DAC successfully developed a compact and scalable Non Contact Vibration Measurement and Analysis System using an indigenous technology based on Multi dimensional profiling of vibrating surface (includes frequency, amplitude, position information varying over time).

Application areas include PCB vibration profiling during vibration tests, Flaw detection of highly attenuating porous materials, Bond strength evaluation of materials, Vibration profiling of high temperature surface etc.

Acoustic Breast Cancer Detection – Evaluation of Feasibility

Presently used X-Ray Mammography and MRI has some adverse effect on the body of the patient. Sonomammogram is an acoustic resonance image (ARI) created by vibrating breast tissues with low frequency acoustic wave and a Doppler scanner. Sonomammograhy works for dense breast, and is low cost compared to MRI and X-Ray mammograhy. Sonomammograhy helps to evaluate and detect the micro calcifications (or cluster of micro calcifications) in breast tissues which may lead to cancer. Visualisation of micro calcification under ultrasound will enhance detection and assessment of breast cancer, allowing for improved evaluation without exposing to radiation.

The objective of the project was to establish the feasibility of mammography using acoustic and ultrasonic techniques. Existing breast imaging techniques and the behavior of various types of breast cancer cells were studied and the basic requirements for an experimental system was formulated. A prototype system having a 2 MHZ Transmitter and a matching receiver card was developed, which could successfully detect an echo measuring 40 micrometer using copper wire. This is a significant improvement compared to the minimum detectable lump size of 2-3mm in Sonomammography, and the 0.8mm (800 micrometer) resolution of the X-ray mammography. The technique has the added advantage, as it is free from ionizing radiation.

Acoustic Eavesdropping Device

The objective of the project is to develop low-cost Real-time Monitoring System for detection, reception, encryption and transmission of acoustic signals created by humans, without their knowledge, for online analysis. The flow of illegal immigrants, smugglers, and terrorists across national borders are big concerns for Indian security. The Indian Defense forces are using multiple techniques to stop that and simultaneously looking for viable technology to help them. Recent literature suggests sensor networks as a possible

solution strategy. It can also be used for solving a variety of other social, military, and environmental problems, including secretly monitoring enemy activities in forests or other inhospitable terrain. Once fully developed, battery-powered sensors equipped with built-in radio transmitters to detect and report potential incidents, may be dropped using unmanned aerial vehicles.

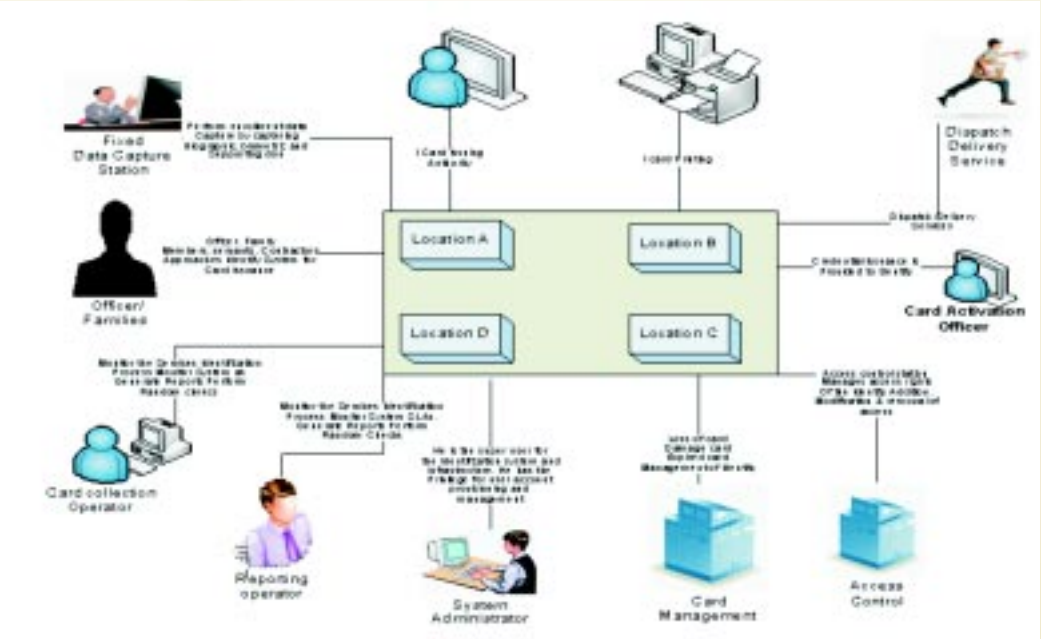
The primary unit is called “Acoustic Eavesdropping Device (AED)”. It is a low cost, rugged, acoustic sensor that operates from a small battery and transmits the information gathered over a wireless channel. Multiple AEDs form a self organizing sensor network and the entire information travels over this network to reach a receiver unit from where it is further transmitted to an analysis centre for on-line analysis and possible control actions.

The system is capable to sense presence of human activity in the vicinity of the sensor network from the vibration and acoustic signals picked up by the sensors. At the trivial level, it can generate an alarm corresponding to the event, which in turn can alert the security system of the enterprise. In actual practice, it can pickup the acoustic signals, compress it into packets and send it to the base station of the security system over the wireless medium. From here, the packets could be sent to a central analysis station and also to the security personnel around the area in an attempt to give them an early warning of the activities.

Consultancy for RFID based Smart Cards for Army, Navy & Air Force

Ministry of Defence, Government of India plans to implement a Smart Card based ID card system and Access Control System for Army, Navy and Air Force. A project was awarded to C-DAC through National Competitive Bidding in September, 2011 with the objective to implement a PoC system in 3 places and to submit a detailed project report towards the implementation of this Smart Card System in Army, Navy & Air Force.

Smart Card (Combination of SCOSTA CL HF standard and EPC global UHF Class 1 Generation 2 standard) along with biometric system (Fingerprint and Iris) is proposed as the replacement of existing paper based access control system. The Proof of Concept has been implemented at two Navy locations and one location each of Army and Air Force. Documentation of a detailed solution consisting of Current Processes and workflows, Gap Analysis, Proposed Workflows, Possible Architectures, Selected Architecture, Sizing & BoQ and Roll-Out Plans is in pipeline.



Design and Development of an Object Tracking System for Environment Sensitive Items in Transit

With an ultra-low power of 50 micro-watt and size of 20X64X6 mm3, a data logger is being developed consisting of Temperature Sensor, memory and Wireless link with visual indicators by which the thermal history of the Vaccine, Blood, Medicines, Perishable items, Photo Sensitive items etc may be monitored, and subsequent fitness for use of the tracked material may be quickly ascertained in reference of real time and position stamping. This product is a single, cost effective, generic, Time – Temperature Wireless Tag which can be configured through high speed USB to mimic the stability characteristics of nearly any material of interest. Future enhancements will give the ability for Real time Location monitoring and facility of incorporation of wide range of sensors as plug-ins with suitable environmental protected package. Target applications include Hospitals for tracking of Blood Bags and temperature sensitive medicines, Cold chains for tracking of food item, and Universal Immunization program

Automated Traction Unit

A traction unit is a therapeutic device to deliver precisely controlled force to patient. Under this DeitY sponsored project, the device has been developed as per PRSG guidance. The project involves precise control of motor for delivering static/intermittent traction force to patient.

Automated traction unit

Analysis of Technology Gap in Mohali Electronics Industry Cluster

TIFAC of DST sponsored a study to understand the technology gap in electronics industry at Mohali. Under this study project, a survey of the small scale units of industry was taken up. The study revealed lack of design and testing facility as an impediment to growth of industry.

Design and development of climate controller for Greenhouse used in Agri-Research

Greenhouses are transparent structures where plants can be grown in protected environment. These are playing an increasingly important role in protected cultivation and agricultural research. An indigenous climate controller is being developed in collaboration with National Agri-food biotechnology institute (NABI). A CAN based monitoring system has been developed. The greenhouse structures are being raised at the site.

Application of Electronics for Agriculture & Environment (eAgriEn)

The eAgriEn program has been initiated for development and deployment of electronics IT products, systems and solutions for agriculture and environment applications and establishment of R&D infrastructure at C-DAC, Kolkata for such applications. A number of sub projects have been initiated under this and achievements in these are listed below:

Development of Handheld Electronic Nose: It is executed jointly by C-DAC & CGCRI, Kolkata. Handheld Electronic Nose is a portable artificial olfaction system based on a 16-bit PIC Microcontroller platform with an effective GUI interface, which is applicable as an industrial PDA for Tea Quality Assessment Device based on its aroma.

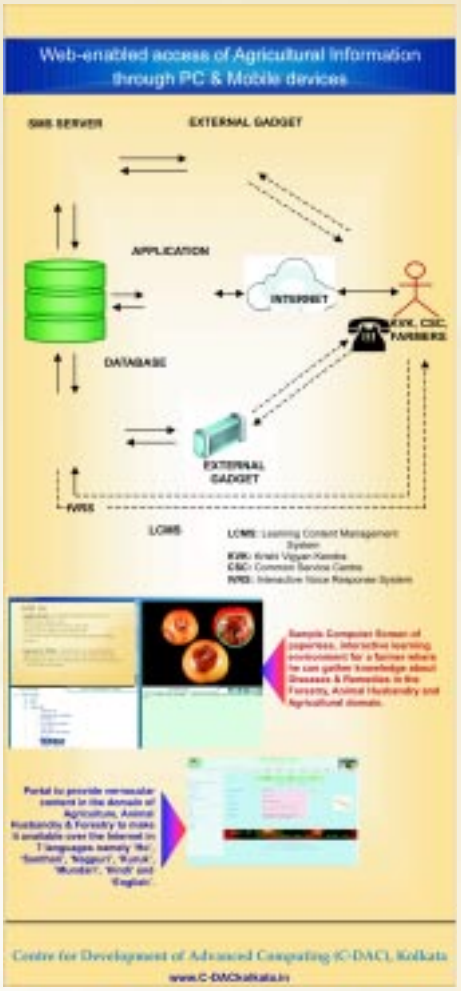
Development of Decision Support System using Wireless Sensor Network: It is executed jointly by C-DAC & TRA, Tocklai. Wireless sensor network system will capture different data from sensors and build a database of physical, chemical and physico-chemical properties of soil as well as of tea leaf surface and computer aided tools for Decision Support System (DSS) will be developed for making important decisions for different farm level (tea garden) operations. Prototype system has been deployed for field trial.

Development Of Membrane Electrode Array Based Nobel Sensing System For Rapid Taste Characterization of Food & Agro-produces: It is executed jointly by C-DAC & IIT, Kharagpur. A base polymer, e.g., polyethylene, will be formed into a membrane or film for taste sensing electrode. These membranes will be further functionalized by chemical reaction with suitable reagents for the purpose of recognizing the chemical components as electrolyte or non-electrolyte for water as well as for tea. Taste sensing response for analyse (tea liquor/ drinking water) will be measured using the membrane electrode as prepared in terms of membrane electrode potential (vs. concentration)

Development of Image Processing Applications For Tasar Sericulture: It is executed jointly by C-DAC & PRADAN, Jharkhand. Digital image processing system based on web camera with colour analysis software has been developed for colour characterization of Reeled, as well as Spun Yarn of Tasar Silk. Development of colour analysis solution, has been completed. This system would serve well to Silkworm seed production centers and tasar yarn producers

Detection of Obnoxious Smell in Pulp & Paper Industries: It is executed jointly by C-DAC & NEERI, Nagpur. Electronic nose is being developed for monitoring of obnoxious odors such as Dimethyl Sulphide (DMS), Dimethyl Disulphide (DMDS), Methyle Marcaptant (MM) and Hydrogen Sulphide (H2S) generated from Pulp and Paper Industries

Web Enabled Access of Agricultural Information (WEAAI) through PC and Mobile Devices: It is executed jointly by C-DAC & BAU, Ranchi. The system will be used to disseminate Agricultural Information to the farmers in the state of Jharkhand. Content is being developed on the areas of agriculture, animal husbandry and forestry in seven languages namely English, Hindi, Nagpuri, Santhali, Kurukh, Mundari and Ho. The solution involves vernacular web enabled interactive access, offline content delivery using LCMS, guided and unguided SMS in push as well as pull mode & IVRS technologies for interactive and non-interactive dissemination of agricultural information. The USP of the system is dissemination of information in local languages covering almost all available modes of interactive communication.



PAN C-DAC Perception Engineering – Application of ENTV System in Agri-cultural & Environmental domains:

The objective is to develop an application of E-nose, E-Tongue and E-vision for covering a broader spectrum of applications in agricultural and environmental domains. Applications targeted include chilies and turmeric. Quality of chilli can be characterized by colour, length, broken percentage, presence of pod less stalk, foreign matter, etc and quality of turmeric can be characterized by length, broken percentage, unboiled percentage, number of bulb, texture, size etc. A low cost PC based image processing system has been developed to acquire live images of chilli or turmeric. A PC based image analysis software has been developed to analyze the above characteristics. Then colour analysis is done to estimate quality of chilli and turmeric.

Software Screen shot of Chilli Analysis

Development of ICT Technologies for Smart Buildings with Low Carbon Emission

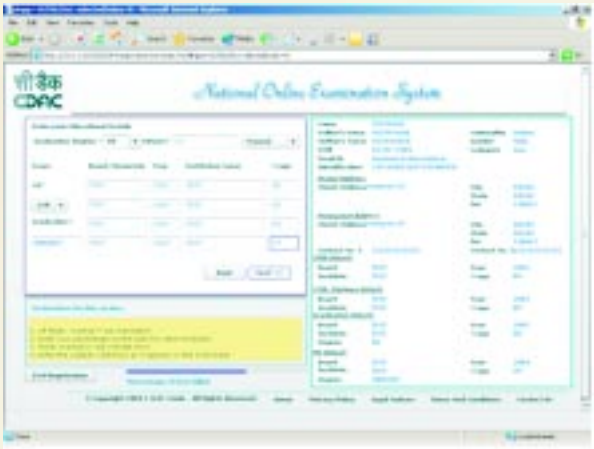
Objective of the project is to develop ICT Technologies for energy efficient Smart Buildings leading to low-carbon emission economy. It is proposed to develop technologies and tools for design, deployment and maintenance of illumination control, HVAC, air quality measurement and control systems. The physical outcome include design and development of ZigBee enabled devices with digital and analog I/Os sensor interfaces, PWM controllers to cater for lighting control systems viz. switch, light, doors / windows, and access control systems, energy measurement, enabling interface for air quality sensors, Zigbee coordinator / controller & router, solar and vibration based energy scavenging systems for self-powered Zigbee devices, and wireless multi-protocol gateway enabling 3G and Wi-Fi connectivity to IEEE 802.15.4 sensor networks. The key deliverables from the project achieved during the year are as follows:

Various sensors for presence detection, air quality monitoring, temperature, relative humidity, hall-effect sensors etc. have been interfaced with wireless communication modules and tested with Zigbee stack. Design of interface board with real-time clock, isolated I/O, LCD display to interface with WSN has been carried out. Wireless Multi-protocol gateway to enable integrating IEEE 802.15.4 sensor networks with 2G/3G/Wi-Fi backhaul networks has been designed, and manufactured. The testing of the system is under progress. Energy scavenging using solar panels and Li-polymer battery to power sensor motes have been designed and tested with MSP430F2618 based mote. Multi-hop sensor network has been established and tested with five hops for scalability of sensor motes and Zigbee stack. Other energy scavenging techniques based on vibration, thermoelectric and residual RF power are being studied and analyzed to enable self powered sensor motes.

SOFTWARE TECHNOLOGIES

National Online Examination System

C-DAC has developed an online examination system known as 'National Online Examination System' (NOES) as per requirement of NASSCOM and DIT. The purpose of such endeavor was to design and develop a robust, fault tolerant, secure, scalable and adaptive system through which examinations can be delivered "on demand" basis in selected examination centers spread across the country. Facilities like registration of examinees, online payment of fees, scheduling of exam, creation and maintenance of question bank, role based access control, and comprehensive report generation are provided by the software along with conduction of online examinations and online interviews.



The system is hosted at C-DAC Noida's data centre and have been used in conducting various exams at the national level including ERNET Recruitment Exam, C-DAC Noida's National Recruitment Exam, C-DAC Trivandrum Recruitment Exam, DIT-CCA Recruitment Exam, DOEACC CCC Exam, and C-DAC PG Diploma Entrance. Further, the system has also been used in conducting multi-level interviews for the post of Scientist 'C' and 'D' for the Department of Electronics and Information Technology.

The system has been certified by STQC which carried out functional, performance and security testing. NOES have been launched by Hon'ble Union Minister for Communications and Information Technology, Sh. Kapil Sibal on November 21, 2011.

Centre of Excellence for Digital Preservation

As per the recommendations in the National Study Report on Digital Preservation Requirements of India, Department of Electronics and Information Technology has sanctioned the Centre of Excellence for Digital Preservation to be established at C-DAC Pune. It is a flagship project under the National Digital Preservation Programme (NDPP) of DeitY. As per the requirement of this project, C-DAC has signed MoUs with National Archives of India and Indira Gandhi National Centre for Arts. C-DAC also plans to preserve the legal records produced through e-court initiative. The objectives of Centre of Excellence for Digital Preservation are as under –

- Conduct research and development in digital preservation to produce the required tools, technologies, guidelines and best practices.
- Develop the pilot digital preservation repositories and provide help in nurturing the network of Trustworthy Digital Repositories (national digital preservation infrastructure) as a long-term goal
- Define digital preservation standards and consolidate and disseminate the digital preservation best practices generated through various projects under National Digital Preservation Programme
- Provide inputs to DeitY in the formation of national digital preservation policy and strategy
- Spread awareness about the potential threats and risks due to digital obsolescence and the digital preservation best practices.

National Resource Centre for Free/Open Source Software NRCFOSS Phase-II

This project which is now nearing completion is a consortium project led by CDAC Chennai. Two other CDAC centres (Mumbai and Hyderabad), IIT Mumbai and IIT Chennai are other members. The major achievements of the project at CDAC centres include the following:

- SaaS Stack framework developed based on Grails, PostgreSQL and plug-ins that enables Multi-tenancy, Security and RBAC (Role based Access control).
- MyDesk application has been enhanced with e-Gov standards based data schema, multi-tenancy, role based access control, tenant based application customisation, cross browser support, and on demand elasticity.
- Video streaming (Live telecast) application for Netbooks.
- A number of enhancements to the NRCFOSS Portal including addition of section on Open Source Compliance.
- BOSS Linux portal has been revamped to enable user-friendly downloads and interactions, and build BOSS community
- BOSS Linux Desktop edition: Work initiated for desktop edition 5.0
- FOSS repository of e-governance, and scientific categories updated with lot of applications and tools in those domains with subcategories in each domain

Implementing e-Forms Application through State Portal and SSDG in the State of Jammu & Kashmir (J&K SSDG)

This project has been formulated under the National e- Governance Plan (NeGP). The project enables citizen of Jammu and Kashmir to submit forms online for the Government services using SSDG and state portal. Citizen can also check the status of his/ her application online. These submissions and status tracking can be done through the CSCs or through the State Portal directly. The J& K Government has identified the below services to be developed and ported under this project..

- Two services of the Social Welfare department (1) IGNOAPS, (2) NFBS
- Two services of Employment Department (1) Registration, (2) Renewal of Registration
- Three services of the Health and Medical Education department

Prototype for Application for Age certificate service was demonstrated to the H&ME department officials for approval. Application for medical certificate and Application for physically challenged certificate are also complete and are awaiting sign-off from the H&ME dept. The project also includes sensitizing SSDG through training and workshops, for which DOEACC, Jammu has signed MOU and Certifying the services through STQC.

State e-governance Service Delivery Gateway (SSDG)

Implementation, deployment and maintenance of SSDG is done by implementation agencies chosen by the respective state. C-DAC provides the software solution and support for the gateway. In order to ease the efforts of implementation and deployment of SSDG, C-DAC has developed an installer and also numerous manuals that provide detailed knowledge of SSDG deployment and connector development. C-DAC provides consultancy and guidance to the implementation agencies in developing the connectors to integrate the developed services to SSDG. C-DAC also provides the testing environment to the Implementation agencies for integrating their services with SSDG.

SSDG is already up and running in six states (TamilNadu, Goa, Manipur, Meghalaya, Puducherry and Himachal Pradesh) and getting ready in another six states.

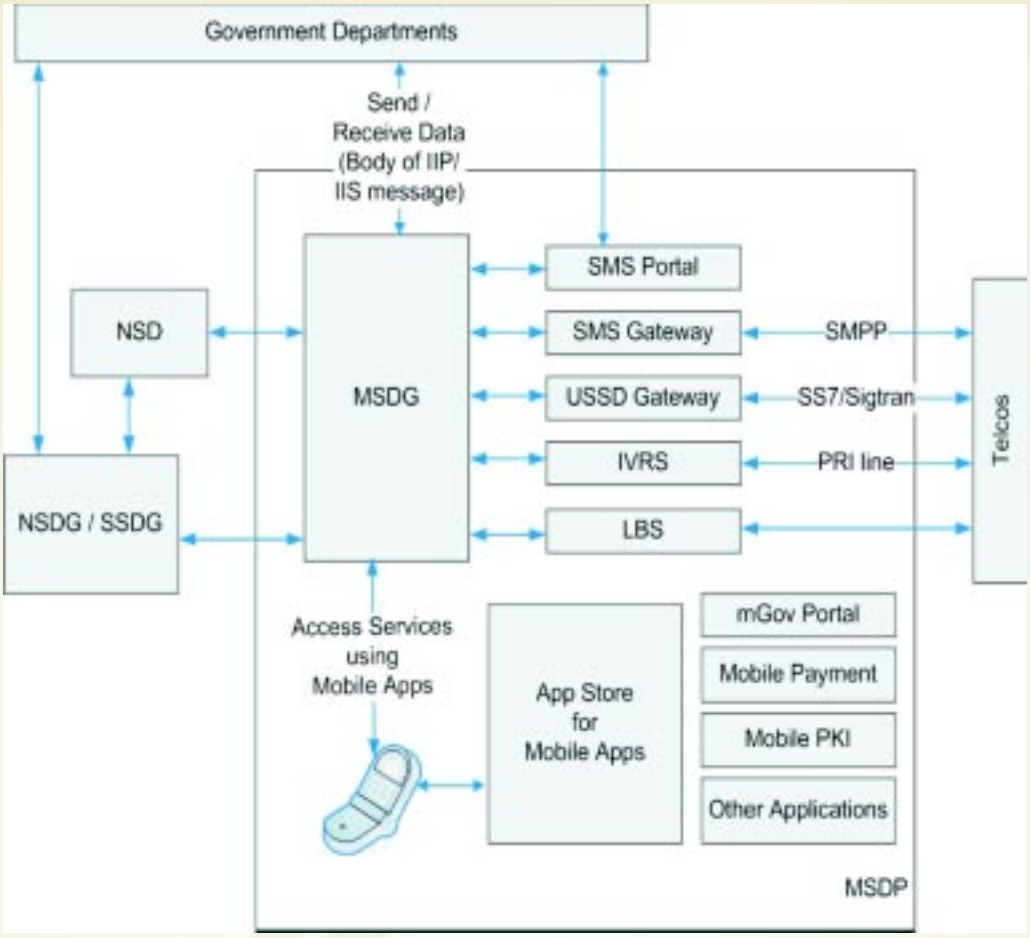
E- Forms

e-Government services require multiple forms to be made available to citizens. A lot of information is common in majority of the forms. The e-Forms engine Fulcrum designed by C-DAC allows to generate e-forms as per the e-Governance standard specified by DeitY. Fulcrum can be hosted on state portal and can be downloaded by citizen for the purpose of online as well as offline submission of the forms.

In Phase I, repository of 40 e-Forms has been created successfully. In PhaseII, Biometric verification for fingerprints and XML Signature integration has been integrated with e-forms. A number of workshops were organized for giving orientation of the tool.

Mobile e-Governance Service Delivery Platform (MSDP)

Mobile e-governance Services Delivery Platform (MSDP) provides an integrated platform for delivery of government services to citizen over mobile devices using SMS, USSD, IVRS, CBS, LBS, or mobile applications installed on the mobile phones. Following diagram shows the various components and the architecture of MSDP.



Support for SMS, IVRS, USSD and LBS are ready. SMS gateway is already in use by a number of services in Goa, Delhi, Maharashtra, Meghalaya, J&K, Manipur, Pudducherry, Nagaland, Karnataka, and Himachal Pradesh along with the services Maharashtra Public service commission and National Population Register. IVRS and USSD facilities are used by 5 services in Goa and 2 services in Maharashtra.

Architectural Framework Development for e-Governance Systems (AFDES)

Evolvability is a major concern in the current scenario of continual evolutions in business, science and technology. Design deteriorates after a number of evolutions. If we focus on the systems which continually evolve then the percentage of deterioration is directly proportional to the frequency of evolution as much as to the complexity of evolution. Such systems face the cumulative change impact of much greater extent leading to higher degree of software erosion. To solve this problem, we need systems which when evolved even at high frequency will not face the design erosion. We are working on a design methodology which supports the software design to be more evolvable. The methodology consists of a collection of techniques that, individually and in concert, support flexible, systematic, and dynamic evolution of software architectures in a manner that facilitates preserving of desired architectural properties as well as correctness of ongoing transactions. At the first level we define an architectural style Temporal Control Flow Rule-based Architecture (TeCFRA) for catering to the need of continually evolving systems.

Decision Support for Automated Refactoring (DSAR)

Software changes and grows even in the maintenance phase of software development. These changes make software difficult to maintain and understand. Refactoring techniques were proposed by various researchers to modify the design of the software

without affecting its external behavior and improve maintainability as well as quality of the software. However, to apply these techniques one needs an expert in that domain and in the technology used. 'Refactoring Escort', the tool developed under this project tries to bridge this gap.

This tool analyzes the source code with the help of metrics and techniques such as concept lattices, and identifies classes, methods, attributes that need restructuring. Tool also provides guidelines about which refactoring technique should be applied for the identified element. Current scope of the tool is limited to Java; however, the design can be extended for any object oriented language.

Video Compression and Decompression for e-Learning (RTVCD)

The project aims at developing codec for image as well as video streaming for e-learning applications that will work on lower bandwidths. An image codec developed under the project helps to compress images drastically and works well with images as well as text. The codec will be used to compress and decompress lecture presentations. For video codec, webm technology is used to compress and transmit the video. The tool is developed and is being integrated with LMS software "Brihaspati-2".

IIT – JEE Online Registration System

IIT conducts national level examination called Joint Entrance Examination (JEE) for admission into various IITs at under graduation level. IIT provides offline as well as online mode of application filling for the candidates. This time the task of developing online application filling was assigned to C-DAC. The applications expected were 3 to 4 lakhs and may have more load on the system during the closing of the application filling deadline. This required good performance and good security. Project was executed successfully with a record 3.75 lakh application filling through this software and very satisfactory feedback was received from IIT.

Establishment of BOSS Linux Support Centres & Business Development

The BOSS Linux Support centre project phase-I has got completed in May 2011. The project involved setting up of support groups across the C-DAC Centres. Key achievements during the year include:

- BOSS Linux chosen by Govt of Tamil Nadu to be deployed in the 9 Lakhs Free laptop Scheme distribution. Currently deployed on 2.65 lakh laptops
- Received Supply order from Indian Navy towards customisation of secured BOSS Linux
- MOU signed with Indian Navy for providing onsite support to BOSS Linux at Naval Headquarters and Naval Commands for two years.
- Close to 1 lakh+ deployment of EduBOSS at Punjab & Haryana under the Sarva Shiksha Abhiyan programme

As part of the development efforts - EduBOSS 2.0 – an up-gradation of EduBOSS 1.0 was released during Elitex 2011. EduBOSS 2.0 feature latest kernel updates, Gnome updates and new tools.

Teachers Training & Student Talent Transformation

"Trainers Training & Student Talent Transformation for CBSE" is a C-DAC-CBSE project for using Free/Open Source Software (FOSS) to facilitate CBSE teachers and students in teaching-learning process and innovative projects. C-DAC is developing instructional materials and multimedia self-learning materials augmented with animation in Maths, Science and Social Sciences for IX and X Std CBSE Courses. The repository is to be made available to all CBSE schools with question banks, test instruments and other features. The project is coordinated by C-DAC Chennai with C-DAC Chennai/Bangalore/Mumbai & Delhi as the implementing agencies.

Moodle has been chosen as the platform for content Repository of e-learning resources. The first draft of the content for Math, Science and social science subjects with e-content / animations /question banks is ready.

Customized EduBOSS distribution with relevant utilities / tools and learning resources relevant to ICT is ready for CBSE school requirements.

Fund & Accounts Management System

The FAMS developed as part of the Saakshar Bharat Portal by C-DAC was formally launched by Shri Kapil Sibal, Hon'ble Union Minister for Human Resources Development and Communications & IT on 1st September 2011. The FAMS User Manual was released by Shri Sachin Pilot, Hon'ble Union Minister of State for Communications and IT. FAMS incorporates a unique fund flow design with real-time updation to enable the monitoring of funds at all levels leading to increased transparency, and is open to public scrutiny. Delivering his address, Shri Kapil Sibal stated that accountability and transparency can be achieved only through innovative use of ICT intervention which is very effectively incorporated by C-DAC in the Sakshar Bharat Portal

Launch of FAMS by Shri Kapil Sibal, Hon'ble Union Minister for Human Resources Development and Communications & IT

Anywhere Registration, Anywhere Encumbrance and Anywhere Certified Copies Services

As part of the KAVERI solution implemented by C-DAC, two new services for issuance of anywhere encumbrance and anywhere certified copies and the facility for anywhere registration was launched by Shri D. V. Sadananda Gowda, Hon'ble Chief Minister, Karnataka on 5th November 2011.

Mobile based information management and communication System

A mobile based tourist information service, namely, “eParyatan” has been developed for tourists within India, through which tourist related information, from tour planning to tracing of information “on demand” basis can be delivered to end user. Tourists can

navigate the Tour Planner on basis of budget and time. System includes Tour Guide which lists places of interest, information about visiting places, Routes/Map tracking with geo coding and reverse geo coding. The navigation is based on real tracking as per current position along with manual search.

India Development Gateway (InDG)

India Development Gateway (InDG) is a nationwide initiative that seeks to address the livelihood concerns of the rural communities through provision of responsive and credible information, products and services in local languages. Developed as part of this initiative, is the multilingual web-portal - www.indg.in. The web portal is presently available in nine languages, covering information related to six key livelihood sectors (Agriculture, Health, Social Welfare, Primary Education, Rural Energy and e-Governance) related to Rural Development.

Content and services have been added for two more languages (Malayalam & Gujarati). The portal now include value added services like VLE corner, course on financial literacy, online quiz for children and solar applications for CSCs. The 'Ask An Expert' and 'Dynamic Market Information' services developed as part of this project have been customized and handed over to State Agricultural Departments of Andhra Pradesh and Tamil Nadu for scaling-up. The team organized 34 outreach events at district, village level (multi-stakeholder workshops, training to VLEs and ICT awareness events to community) in 6 states.

Content Generation, Adaptation and Distribution in M-Learning Environment

This project is being jointly executed by C-DAC and Thiagarajar College of Engineering, Madurai, Tamilnadu. Major objective of the project is to develop mobile learning content suitable for finishing school students and adapt & render the developed content for mobile phones. Also, a mobile video streaming application has to be developed, to distribute the mobile learning content to the students. This mobile video streaming application was successfully developed. A video recording studio has been setup. Also sample m-learning content was developed.

Development of Service Oriented Architecture based Standards Compliant e-Learning Framework

Objective of the project is adoption of Service Oriented Architecture in the form of web service implementation for global access of e-learning service by other e-learning systems. Provision of decision support system using web mining/data mining techniques to the instructor, implementation of Rich Internet Application (RIA) enabled client interfaces to achieve enhanced user interaction, and development of suitable personalized e-learning services enabled with web 3.0 or Semantic Web to provide the context awareness support to the learner for the given content.

Standards compliance features like SCORM conformant Course Organizer and QTI conformant Assessment has been incorporated. Development of Web Mining algorithm for incorporation into e-Learning framework has been completed. Also developed SCORM compliant content conversion tool.

Development of Collaborative Class Room

Collaborative Class Room (CCR) is envisaged as an application leveraging on distributed resources and high speed network connectivity to support key factors of online educational environments viz., visualization, interaction and appropriate learning pedagogies.

CCR application has been upgraded with newer features like multi-whiteboard facility and GSRM based wiki for instructors and learners. Echo cancellation functionality has been implemented and is being tested.

e-Learning Quality Research Project

Developed a portal to provide services for evaluation of Learning Management System (LMS) applications and content by integrating our quality analytics framework for e-content evaluation. The integrated services will be made accessible through web. Discussions are in progress for developing 'Code of Practice for e-Learning Application Quality Analysis' as a standard for LMS evaluation.

Open Source Walk-in e-Learning solutions Laboratory

An open source walk-in e-Learning laboratory is setup which includes e-Learning standard compliant solutions like Learning Management Systems (LMS), Learning content management systems (LCMS), Video Streaming Servers, Content authoring tools and tools to create media elements such as animations, audio, and video. Through this lab one can get exposed to various open source solutions and their usage, so that one can setup similar systems at their premises with minimal effort. Two online courses in the areas of Linux System Programming and Linux Kernel Programming & Device Drivers are also being offered.

Development of Testbed for advanced research in Multimedia over IP in an inter-networking environment

The project primarily involves development of inter-working solutions for multiple access technologies as part of Next Generation Network. This includes creation of seamless and ubiquitous environment for mobile users to keep multimedia services alive while switching access technologies, thereby adapting to heterogeneous environment with varied terminal capabilities. The project incorporates standardization efforts like IEEE 802.21 and IP Multimedia Subsystem (IMS) to develop such a seamless platform for multimedia and other services.

One major contribution is the development of an IMS based environment incorporating seamless mobility across Bluetooth, WLAN and Ethernet technologies. As the existence of such an integrated all-IP media independent service environment would also compel the need for a future heterogeneous testbed to monitor multimedia streams across diverse access technologies, the team has also developed and deployed a testbed to monitor audio and video streams. The testbed would also generate diverse packets to monitor and evaluate performance and Quality of Service (QoS) of applications in such an environment. A number of other components have also been developed such as Dynamic content customization for stream based applications, Quality of Service algorithm for heterogeneous networks etc.

Online data collection and Processing

Online data collection and processing software had considerable impact on e-governance resulting in more participation due to quick response and transparent results. This service has been provided to various departments of Punjab like Sarv Sikshya Abhiyan authority Govt. of Punjab, Water Supply and Sanitation Dept., Govt. of Punjab, Punjab State Warehousing Corporation, Punjab Agro Industries Corporation, Punjab Health System Corporation, Department of Health & Family welfare, Punjab state Agricultural

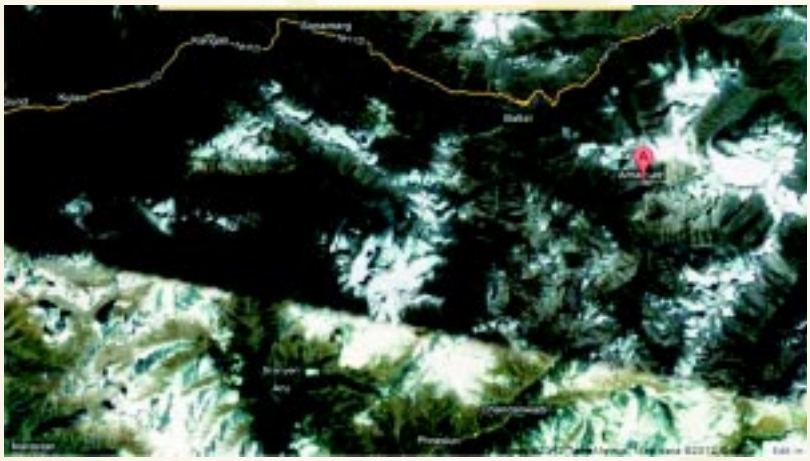
Marketing Board (Mandi Board), Punjab Police Department, Subordinate Service Selection board, Punjab, Agriculture Co-Operative Staff Training Institute (COOP Bank), Punjab Pollution Control Board, Punjab State Transportation Society, AFPI, PICTES PUNJAB, Punjab State Transmission Corporation Ltd, etc during the year 2011.The data entered is authenticated without redundancy and secured. The interface has been simplified to tap the resources even at rural level. During the year 2011 total no of records processed were 457559.

Mobile Computing and Applications

The project uses mobile technology mainly to serve Governmental establishments to improve their service delivery among its citizens and also to help Research Organizations to develop application of research areas like mobile communications to e-Governance. Major objective of this project is to use mobile computing to exchange information with citizens, businesses and government departments reaching to the innermost layer. Work is in progress on transport Application using NFC, Order Management Software for the common people, and Mobile based location service for vehicle.

Context Aware Augmented Reality Framework Development

The project also involves developing a context aware augmented Reality applications development framework on one mobile platform (Android). The goal of Augmented Reality (AR) is to add information and meaning to a real object or place. Unlike virtual reality, AR does not create a simulation of reality. Instead, it takes a real object or space as the foundation and incorporates technologies that add contextual data to deepen a person's understanding of the subject. This project aims at creating a software framework to develop AR applications. An architecture for the AR framework has been defined. The key deliverables from the project planned and achieved during the year are as follows: a Mobile Communications Lab established; Requirement Specifications and High level Design completed; and implemented two marker detection algorithms critical for Augmented Reality (AR).



Web based Phulkari

India is large country enriched with traditions and customs of different states and of different peoples. Indian embroideries are one of them which has given a base to all the textile and fashion industries and markets but today traditional embroideries are near to end .The objective of this project is to give space and life to such traditional and hard to find embroideries. The main features are:

- To make available all the information regarding Indian Embroidery on a single portal, including embroidery techniques, types of threads to be used, texture of clothes and colours, and blue prints
- To develop an online application for both, amateurs and professionals, involved in Fashion designing.

Design & Development of Websites

For National e-Governance Plan (NeGP): National e-Governance Plan (NeGP) covers 27 Mission Mode Projects and eight support components to be implemented at Cen tral, State and Local Government levels. NeGP portal is a single gateway to access all the government facilities provided under the NEGP. The features of the portal are CMS based web portal, Social networking website embedding, Linkage to all state portals, Integration of internal tools of DeitY, etc .

For public diplomacy division, MEA: The website for Public Diplomacy Division of the Ministry of External Affairs (MEA PD), Government of India aims to reach out to the younger citizens of our country, that is, essentially to the under 30s' age-group. By incorporating the social networking tools offered by Web 2.0, the new website seeks to increase participation of youth in planning, policies and other issues faced by the government. The website houses lecture series, allow formation of opinion through blogs, communities and groups, provide scope for submitting suggestions, information about India, and so on.

For Cyber Appellate Tribunal (Government of India): The website provides information regarding the department and its working. The website has its own forum to discuss the issues related to the department. A live video chat has been included. The website also facilitates user to file a report online and to get the status of the report. User account also shows about the notifications issued and for next date or the judgement.

For Department of Welfare, Punjab: This is a CMS based website for all the four units under the department of welfare, Punjab. The website has been developed according to GIGW guidelines and will go for security audit. It is a bilingual website.

For Directorate of School Education, Haryana: Portal for Directorate of School Education, Government of Haryana is a collective website which will incorporate the information of Sarv Shiksha Abhiyan (SSA), and day to day orders, notices, instructions, shemes, rules and procedures.

Design and development of software for Counter terror Tracking System (Punjab Intelligence Department)

Counter Terror Tracking System is a planned system for managing information of criminals / terrorists / accused in an efficient manner. The processed information supports the concerned users / department officers in retrieving the required details in minimal time. The advanced level data of criminals is entered in the system and based on that data tagging and grouping is done automatically as well as manually. The advanced search on different criteria's is also provided in the system.

Online Courses and Resources in Sanskrit

The objective of the course is to develop e-Learning courses for Sanskrit in the fields of Veda, Shastra and Self learning of Sanskrit. Ar present, we have completed the following:

- IVP – Introduction to Vedic Processing
- ADAS – A deeper appreciation of Shastric concepts
- Swadhyaya – Self learning of Sanskrit. This project provides online video lectures, Transcripts of video lessons, online exercises, additional reference material and basic analytical tools for the course.

Adaptable e-Learning Accessibility Model for the Disabled

This is an e-Learning initiative, first of its kind providing an Indigenous solution for the cognitively disabled. The e-Learning environment that is being developed is both Accessible and Adaptable, covering both web accessibility guidelines and the Pedagogical aspects, like Discrete Trial Training of Applied Behaviour analysis (ABA) and Theory of Multiple Intelligences. This enables teachers to customize curricular content to the special needs of children with ASD attending any regular or special school model. The scope of the project is within the Spectrum of Autism, addressing the needs of children with ASD with Mild Mental Retardation.

We are collaborating with National Institute for the Mentally Handicapped (NIMH), Secunderabad for evolving a feasible and methodical e-Learning model for teaching ASD children so that in-service and pre-service teachers develop an insight into learning methodologies for ASD.

Overall Architecture

Delhi Tourism Online Ticket Booking System

The online ticket booking system is designed and developed by C-DAC for tours operated by DTTDC via integrated Payment Gateway. Users across the world can select & book tours online and system will generate e-ticket which user has to carry at the time of travel; same is also sent through email.

IPR Services provided by the Patent Search Centre

There are two prior art search centers at C-DAC Pune and DeitY, New Delhi for providing patentability/ inventiveness opinion on ICT related technologies. The main activities of search centers are to diffuse information about IPR, spread awareness about the same, devise tools and technologies for easy access to databases and above all to guide, nurture and stimulate growth of SMEs, Start Ups and Academia in all sectors and especially in the area of ICT.

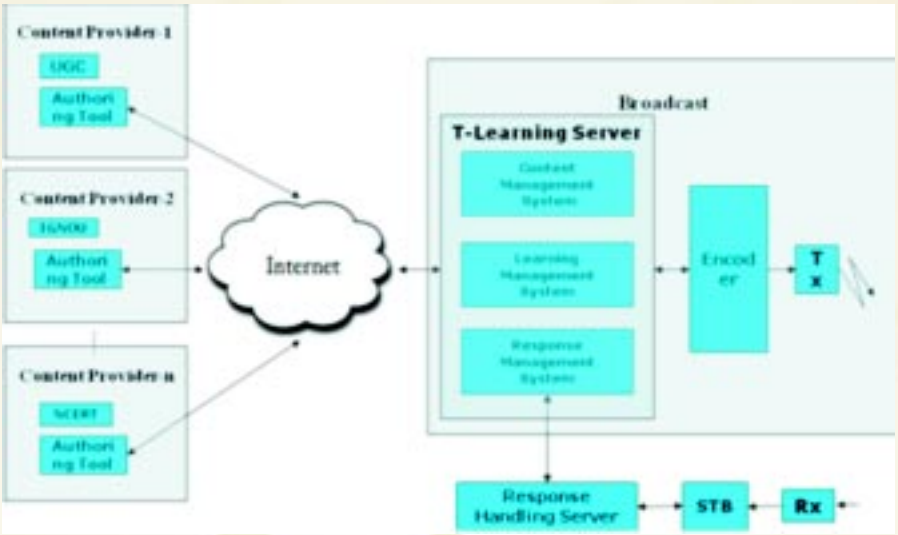
The statistics of the services offered through the IPR portal for the year April 2011- Mar 2012 is given below:

Sr. No	Name of the Service	No. of Queries Replied
1	IPR Query	139
2	Prior art Search	77
3	Invention Analysis	35

The IPR portal was enhanced with new features including Case Studies, Success Stories, Archives, IPR News, Top Videos, SMS Alerts sent for Patent Alerts, SMS/Mail alerts for new events.

T-Learning: TV based Interactive Learning

T-Learning refers to interactive access to video rich learning materials primarily within the home, through a TV. T-Learning combines TV transmissions with a specific MHP application creating a multimedia programme which is a mixture of television and e-Learning. T-Learning could prove highly beneficial to regions where access to internet-enabled computers is significantly low. T-Learning has a wide variety of applications.



Block Diagram of T-Learning Framework

Graph Mining Tool (GMT) Framework

Pruthak is a graph mining tool prototype based on unified framework for graph mining and analysis of extracted substructures. The tool provides preprocessing, frequent substructure discovery, dense substructure extraction and visualization techniques for graph representation of data. We conducted study on the DBLP dataset for mining and analyzing substructures using this tool. The study results have demonstrated the correctness and usability of the tool. The tool prototype was made available for download on C-DAC Mumbai website.

We are now working on 'discovery of related services' available in eGovernance domain. The system will provide related services information for the user's search criteria. The framework will capture all the information relevant for mining and analysis of services from the respective Service Providers. The mining of related services from a huge number of available services is a research challenge, which will be addressed in this project. Mining of Constellation of Gateway logs in order to conduct analysis on the available services is also part of the framework. A Proof of Concept is being developed based on the proposed framework.

Multi- Modal HCI for Computer Desktop

The proposed system extend the conventional user interface by offering users the choice of speech, digital pen (for hand written), and camera [for gesture input] in addition to the conventional input devices keyboard and mouse for interacting with the system. A PoC was developed through which user can control the screen cursor through finger gesture (which will be captured via web-cam) and can also issue command through speech. The system is targeted to Spastic and disabled population. We are working with Spastic Society of Karnataka, (an NGO working for the empowerment of Spastic People) for collecting the requirement and testing the system. Prototype has been developed and demonstrated to Spastics Society of Karnataka.

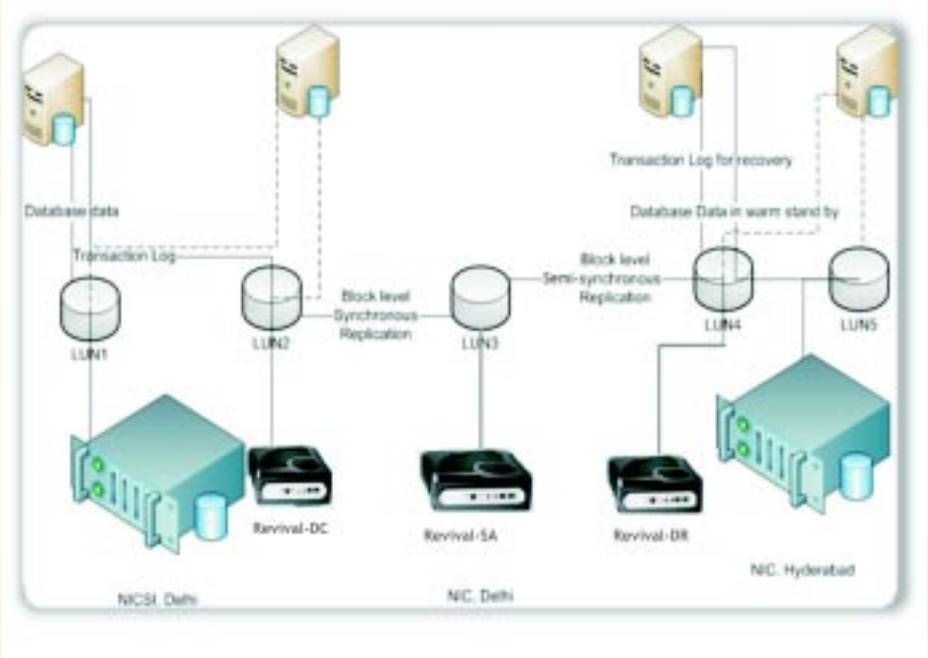
IPSAN based Disaster Recovery appliance: Revival 2000

An IPSAN based Disaster Recovery appliance Revival 2000 (upgraded from Revival 1000) family series facilitates a disaster recovery solution with zero RPO and negligible RTO (also referred as optimal business continuity) for service delivery gateways along with its advanced feature set of software RAID on 64 bit operating system and data security at rest. It has been successfully deployed in National Service Delivery Gateway (NSDG).

The product family has three solutions – Revival synchronous replication, Revival semi-synchronous replication and Revival optimal business continuity. Revival 2000 uses mix of synchronous and semi-synchronous replication with WAN acceleration techniques to achieve optimal business continuity. The product is based on iSCSI standards for block level access to data.

In the current market scenario the only option an organization has is to have DR solution from their existing storage vendor to achieve the optimal business continuity or use host based or database based replication solution to deploy DR solutions which are usually file based and may not give zero RPO.

Revival is a cost effective, host independent, optimal business continuity solution for e-government projects and SMB segment. Advanced monitoring of Revival 2000 provides complete disaster recovery feature set such as switchover, switchback etc.



Enhancing Accessibility for FOSS Desktops

This project tries to look at the practical aspects of accessibility by focusing on creation of open source tools and technologies that address specific needs of disabled people. Various activities carried out under the project mainly try to address the needs of people suffering with disabilities namely, Visual impairment, Physical Impairment, and Cognitive Impairment. These are briefly listed below:

GNU/Linux distribution for visually impaired people: C-DAC has developed a GNU/Linux distribution exclusively for visually impaired users. This distribution uses enhanced Orca with keyboard as main interaction mechanism. Visually challenged users can use it out of the box because accessibility settings required by them are enabled by default. It can be downloaded from http://nrcfoss.cdacmumbai.in/access/GNULinuxForVC-beta-0.1.1.iso.

GEM (GEstures with Mouse): GEM (GEstures with Mouse) is a mouse gesture-based input mechanism which uses gestures for input to the system. Gestures can be drawn using a mouse or some equivalent device like touch pad, joystick, pen tablet etc. This

Input mechanism is intended for people suffering with different kinds of motor disabilities, who may face problems in using mouse and keyboard in conventional way. It provides them with an alternate and effective mechanism for using the system to perform various tasks such as navigation, executing commands & keyboard shortcuts, and launching applications etc. on Linux desktop. A beta version can be downloaded from http://www.cdacmumbai.in/projects/accessibility/gem-beta-0.1.tar.gz.

Facial Expression Analysis Based on Human Perception Model

An Automatic Facial Expression Recognition Engine (AFEREV 3.0) has been developed which can recognize six basic emotional facial expressions of the human beings (irrespective of gender and age) namely, Happiness, Disgust, Fear, Surprise, Anger and Sadness from short video sequences both in offline mode and also in online mode (using webcam). In this project, a new motion based fully automatic person-independent system is in development for Automatic Facial Expression Recognition (AFER) from video. The system relies on gradient based optical flow for feature extraction and decision tree for the expression recognition. The input to the system is a video displaying facial expression in offline mode whereas for online mode using a webcam, a video sequence for 90 seconds is captured and different facial expressions based on frame by frame analysis is displayed. The face region is detected from a video sequence using Haar based face detector for every frame automatically. This has a tolerance of around ±15° of head tilt. At first, a neutral frame is selected based on our developed algorithm and subsequent frames undergo analysis w.r.t this neutral frame. Gradient based optical flow is computed locally within the Region of Interest. The first and second order flow projection statistics is taken as feature attributes. During the training of the system, decision tree is trained to generate a rule base. The trained system recognizes basic expressions based on the rule base. The training and performance evaluation of the system is done on the facial expression video database developed in-house.

AFERE V3.0 software in use

Intelligent Advisory System for Farmers (IASF)

Intelligent Advisory System for Farmers(IASF) is a hybrid system integrating Expert System (ES) and Case-based Reasoning (CBR) for answering queries related to farming activities carried out in Northeast states of India. The system can also be used as an instructional material in educational programmes and students can use it for practical experience with real scenario.

The project was started in June 2010 with the help of agricultural experts from Manipur and Meghalaya. The project will cover all the 8 states of NE Region of India. At present, IASF supports 4 major farming activities, Crop Selection, Weed Control, Pest Control, and Disease Control.

PARIKSHAK: An Online Program Grading Tool

Parikshak is a tool for managing and grading programming assignments/tests online (see Figure). It is a web-based system & grades programs in languages such as C, C++, Java, etc. The system grades the given software program for correctness, by checking its output for pre-defined set of input cases. Apart from testing complete programs, the system can also test code snippets for correctness.

The system also provides a facility to frame debugging questions where the candidate has to fix bugs in given code to give correct output. The faculty can maintain a repository of programming related questions & reuse it in various exams.

Online labs for School lab experiments (Olabs)

Online Labs (Olabs) for school lab experiments provides students with the ease and convenience of conducting experiments over the internet. It has been developed to supplement the traditional physical labs and bridge the constraints of time and geographical distances. This not only reduces the costs incurred for conducting experiments in real time but gives a student the flexibility to explore and repeat experiments till they are thorough.

At present, 30 Physics and Chemistry experiments covering topics like Hooke's Law, Reflection in concave Mirror, Boiling Point of Water, etc are available for online access. [see Figure 1 Olabs Screenshots] Each experiment has sections covering related theory, procedure, animation, simulation, assessment and reference material. These are available in CD form and also over the web.

Salient Features:

- Experiments and evaluation component aligned to CBSE class IX and X curriculum
- Facilitates teachers to adapt simulations to better suit their teaching methodology
- Assessment questions can be posed based on particular stage of a simulation
- Includes features such as recording observations, plotting graphs, calculations, generating lab sheet, etc which enhance the overall learning experience

Olabs Screenshots

Design and Development of a Framework for Adaptive Instruction (FAI)

It is a framework designed for providing personalized instruction to learners based on their individual learner profile which includes their learning style, prior knowledge level, and other characteristics. Learning objectives are customized based on learner profile. For these objectives, content is selected and sequenced based on learner characteristics. The media type of the content delivered also varies based on learner characteristics. One 6th standard school course and a subject from DOEACC's CCC course has been developed using this framework. Testing and evaluation of the system is in progress.

CYBER SECURITY

Design and Development of a light weight data security framework for mobile platforms

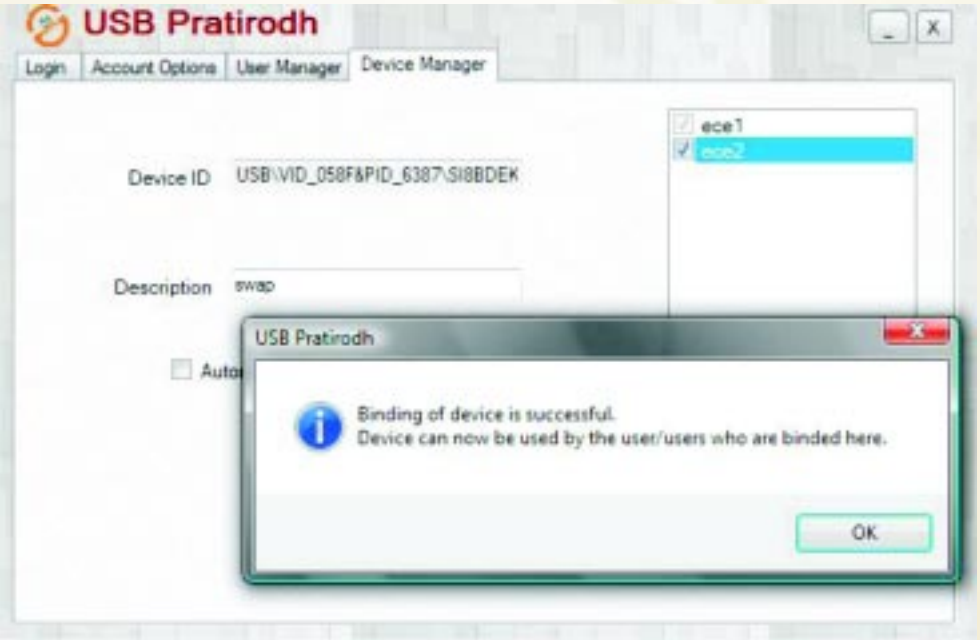
The project aims to develop security components that can be transparently utilized by mobile application developers for making their mobile applications secure. One of the security components would provide confidentiality of transmitted data by encrypting the information flow between the communicating parties. Another service is for authentication of sender and also the integrity of transmitted message. Moreover, security service for key generation and key management will also be implemented so that the developer need not worry about the intricacies of developing them. Since most of the mobile applications require storage of application data on the mobile phone, this triggers the need for secure storage of information, in case the data is sensitive. The project would develop a library that can be used by the developers in case, secure storage of such sensitive data is required. Presently, the framework provides generic APIs to communicate over HTTPS and generic storage APIs for storage on Android and JavaME platform. Design, implementation and testing of secure communicator library for raw, XML and JSON formats over HTTPS as well as framework for generic storage of mobile application data storage on JavaME and Android is complete.

Automated Web Application Security Assessment Framework

The project's main objective is to scan the vulnerabilities of a given target web application / website and assess the risk associated with each vulnerability. With this objective the development of a framework is initiated under which various open source tools are utilized and customization of the output to remove false positives, false negatives, etc are planned and being implemented. Open source tools Nmap, Nikto, Netcat, Harvester, Wget, Openssl and Httprint are used in the framework. These tools are selected based on their performance when compared to other tools and accuracy of information. The framework is integrated with OSVDB database as its base to assess the risk associated for each discovered vulnerability.

Security Solution for mitigating the threats from USB Mass Storage Devices

These days USB devices are popular for data sharing. But these portable devices also pose various threats like unauthorized usage, moving data without the knowledge of the organization and malware easily entering into the organization's computers. This project aims at developing client server solution that controls the unauthorized usage of USB devices in the network, provision for encrypting the data on USB storage drive and guard against malware infection through USB devices.



Development of Enterprise Version (Client-Server) is now complete with GUI, client service monitoring for USB devices, authentication module, kernel mode driver to enforce read-only devices and autorun.inf protection at client side. Server side includes GUI for managing the USB devices, database module, service to communicate with the client and reporting features.

Characterization of UDT for Bulk Data Transfer Applications in High Speed and Wireless Networks

UDP based Data Transfer (UDT) protocol has emerged as one of the next generation high speed network protocol for transferring bulk data in distributed environment. UDT is an end to end application level protocol which acts as a reliable connection oriented transport protocol. The objective of this project is to investigate the usage of UDT and extending its support to provide effective throughput for reliable bulk data transfer applications in Grid & Cloud environments, enabling security for UDT APIs and testing with NKN fabric and last mile wireless networks.

Design and Development of an Anti-Malware Solution for Web Applications and Mobiles

This project aims at developing system level as well as application level browser and web server components in order to protect from web based malware threat. Components planned are desktop browser (IE and Firefox) security add-on, mobile browser add-on, security module for PHP based web server, heuristic based binary analyzer for malware detection, rootkit detection engine and application control.

Application control design is complete and it is being implemented. Application Control maintains application whitelist and controls the execution of unauthorized applications. Explored various PHP security tools and implemented PHP Application Vulnerability Scanner (PAVS) tool using open source solutions.

Screenshot of PAVS Tool

Design and Development of Mobile Device Security Solution

Security concerns are driving a fairly new market in mobile protection. The fragmented nature of the mobile Operating System (OS) landscape has allowed for a number of varied companies to offer different mobile security solutions. Though several mobile security solutions are offered by companies, they try to address only specific threats at the user space. Also user space solutions alone would not be able to address the overall mobile device platform threats. Therefore, in order to provide stringent security for addressing the requirements of critical user groups, it is needed to analyse the threat from multiple angles and evolve a security framework with user space and kernel space components. This project proposes to analyse the threats and evolve reference architecture for providing mobile device security. It also proposes to implement the reference architecture for mobile device security

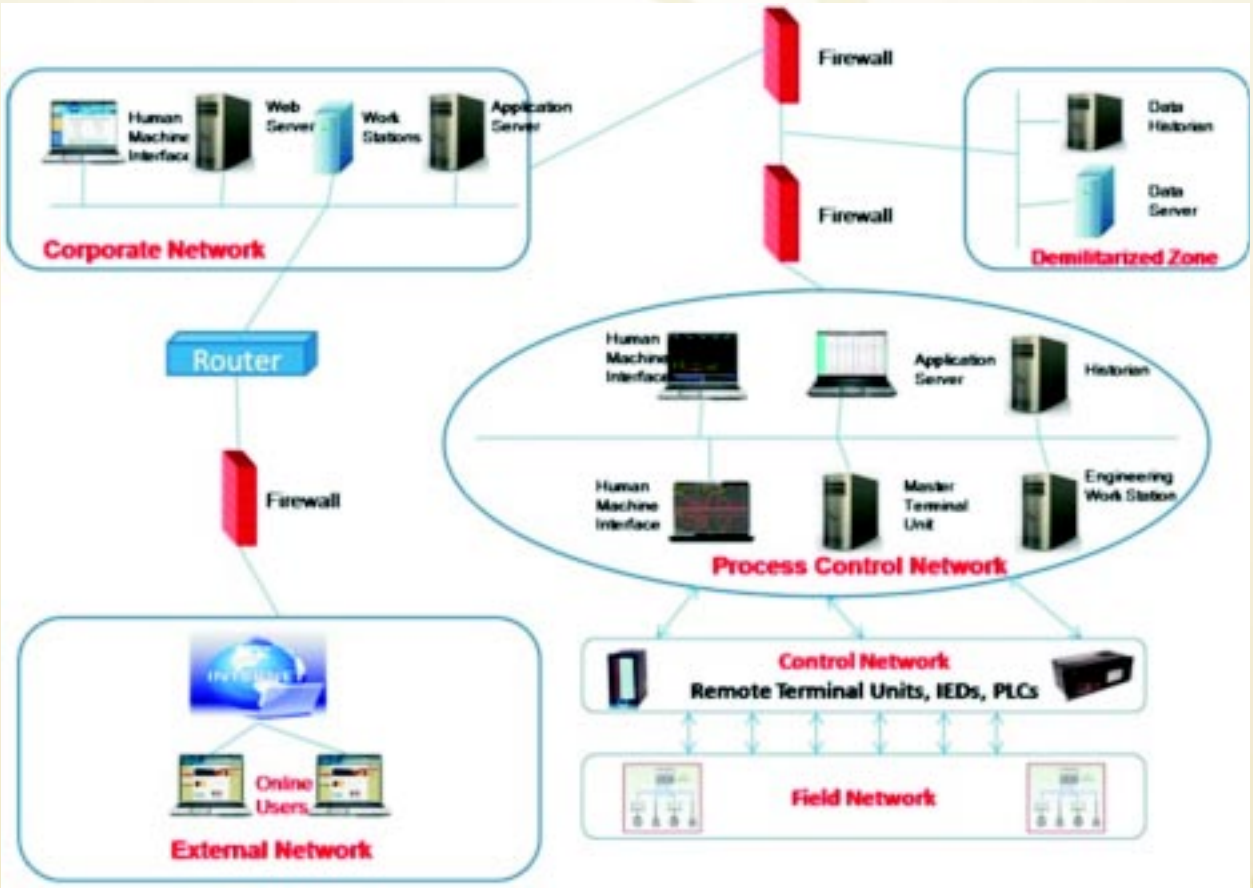
on Android and Symbian platforms. The project aims to finally develop a mobile device security solution to provide features like secure storage, application monitoring & control, local & remote secure device backup & restore, Remote Erase/ Lock and Call & SMS Blacklisting/Whitelisting, etc. Moreover, since most mobile users install vulnerable & malicious applications from the market place without scrutiny, the vulnerabilities in these applications can be exploited for malicious intentions and sometimes malicious applications may also target the OS vulnerabilities. In order to defend against such issues, the project also proposes to develop an offline mobile application analyser that can discover, whether the application possesses any suspicious behaviour like sending SMS, making calls, altering the data like read SMS, delete logs, etc.

Development of Security Solutions for SCADA Systems

It is not always feasible to apply IT security measures to SCADA systems since availability is the top priority for SCADA systems, where as confidentiality is the main concern for IT systems. As SCADA Systems get larger, they necessarily become connected to various networks for both economic and technical reasons, which have been finally integrated into the Internet. This advancement in technology brought new kinds of threats to the critical infrastructures operated by SCADA systems. In this situation it is very important to define, classify and simulate the threats and vulnerabilities and build counter measures against them.

SCADA test bed will be modeled in Defense-In-Depth architecture. Defense-In-Depth architecture strategy includes the use of firewalls, digital simulator for simulating field devices and RTUs, detection and analysis of threats and vulnerabilities and incident response mechanisms. This SCADA test bed can be used for different purposes such as

- Identification, Classification, and Prioritization of Threats,
- Identification of Vulnerabilities,
- Real time security management,
- Simulation of Threats and Vulnerabilities,
- Cryptographic protection for SCADA communication, and
- Simulation of IEC 870-5,DNP3 and ICCP Protocols



Various study reports on various security areas such as malwares, database security, patch management solutions, firewall inspection methods and Best Practices for firewalls in DCS and SCADA systems, etc has been prepared. A number of tools such as DDOSIM-0.2, ETTERCAP, HYENAE-0.36-1, SLOWLORIS, HPING and Trinoo for DoS Attack Simulation have been analysed.

Cryptanalysis: Novel Approach using Intelligent Techniques / Algorithms

The objective of the project is to develop password recovery tools to recover passwords for protected documents of MS Office 2003, 2007, 2010, PDF, WINZIP, and WINRAR formats with the eight character password and character set supporting all 95 printable characters based on GPU/multi-core CPU/FPGA using approaches like brute force search / dictionary attack, pronounceable password based / Markov Model / probabilistic context free grammar, etc., and Enhancement of FPGA based special purpose hardware for 260 DES equivalent cipher text only attack (worst case) within 13 days / 256 AES cipher text only attack (worst case) within a week. The project also aims to design, and develop optimized cryptographic IP cores on FPGA / Multi-core / GPU platforms. Password recovery tool for MSoffice 2003, 2007, 2010, PDF documents has been developed on CPU/GPU/FPGA (Virtex 5) based platforms. The prototype tool is being consolidated on single machine based platform with C-DAC RCS card, NVIDIA and AMD GPU, multi-core CPU. Metadata extraction tool to extract information required to recover password has been tested. Further refinements based on user feedback are in progress.

Development of Cyber Forensics Training Facility in the States of Assam, Meghalaya, Tripura and Sikkim

The objective of the project is to develop and establish State of the Art Cyber Forensics Training Facilities in four states of North Eastern India for the Law Enforcement Agencies, to develop Course materials for various Cyber–forensic training modules and to conduct training programs in the field of Computer Forensics for Police, Judicial Officers, Network Administrators, Students etc. The deliverables of the project are to train 600 candidates in the first year and 600 candidates in the second year in the four NE states, physical facilities for training in the four N.E. states and “Training Modules” for four levels of training, i.e. Awareness Level, Beginner Level, Intermediate Level and Advanced Level. Along with the course content development, Cyber Forensics laboratory facilities have been created in Assam and Tripura. “Awareness level training” has been conducted in four North Eastern states. Beginner level training has been conducted in Assam and Tripura. The project has created significant impacts in the North Eastern states and has generated positive media responses. Development of Cyber Forensics Labs in Guwahati, Shillong, Agartala & Gangtok has been completed. 800 Police Officers/Staff in N.E. States have been trained on Cyber Forensics, expertise developed for analysis of Cyber Forensics artifacts.

Bharatiya Automated Fingerprint Identification System (BharatiyaAFIS)

C-DAC BharatiyaAFIS Suite™ is a family of software development kits/systems, which offers high-performance fingerprint identification for Government agencies. The products are in full compliance with international standards and are equipped with sophisticated utilities and routines offering a range of services viz., image capture, quality control, enrollment, standardized template generation, identification, verification etc., all at high accuracy. This high precision is achieved with the help of fingerprint’s Level III features*, which works in tandem with Level I and Level II features to significantly narrow down the search results.

The BharatiyaAFIS Suite™ has been enhanced during the year and now comprises:

- C-DAC BiometricSDK™ (General Purpose SDK)
- C-DAC ILO-SID BiometricSDK™ (for Seafarer's Identity Documents)
- C-DAC BharatiyaAFIS-II™ (AFIS based on Level I and II features)
- C-DAC BharatiyaAFIS-III™ (AFIS based on Level I, II and II features)
- C-DAC Standardized Template Converter
- C-DAC Fingerprint Image Quality Assessment Tool
- C-DAC Fingerprint Slap Segmentation Tool
- C-DAC Fingerprint (Latent) Image Processing Toolset
- C-DAC Automated Performance Evaluation Tool
- C-DAC Fingerprint Attendance System

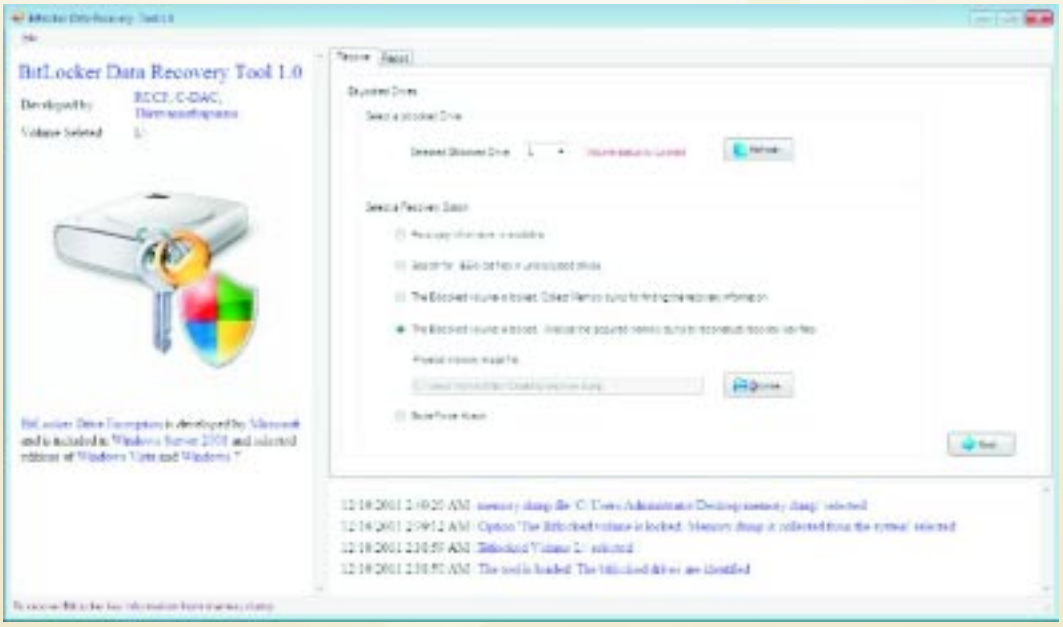
C-DAC is working closely with Aadhaar (UID) project of Govt of India; C-DAC is developing following additional functionalities for them:

- Standards Compliance (FMR and FIR): ISO/IEC 19794-2:2005, ISO/IEC 19794-4:2005.
- Slap Segmentation and Feature Extraction (Aadhaar Enrolment).
- Standardized Template Generation (Raw Images FMRs, FIRs; FIRs FMRs).
- Interoperable Matcher (Aadhaar Authentication).
- JPEG 2000 Support.
- Multiple Language Support (DOT NET, Java).
- Support for Multiple File Formats, viz. RAW, BMP, PNG etc.

Tool for Data Recovery from Media Protected using Bitlocker Technology

Bitlocker Data Recovery Tool is a Windows-based tool to unlock and decrypt drives encrypted using Bitlocker Drive Encryption (BDE) algorithm. BDE is a new technology available in Ultimate and Enterprise editions of Windows Vista and Windows 7. By this, the complete data inside a drive in a storage media can be encrypted. Recovering original data back from a bitlocked drive is a challenge to the investigators when analyzing a suspect's machine, as part of a cyber crime investigation.

The tool developed by C-DAC is able to recover the bitlocker recovery key by different means. It can acquire Random Access Memory (RAM) of the system to a file and can reconstruct the bitlocker recovery key by analyzing the memory dump file. There is a facility in this tool to find the recovery key via Brute Force Attack. Once the recovery key is found, the tool can decrypt the content of the bitlocked drive to recover the original data. The tool works in running Windows systems.



HEALTH INFORMATICS

Telemedicine Deployments

Setting up of Telemedicine Network (Phase-III) in Odisha: The objective of the project is to setup Telemedicine network consisting of three Telemedicine Referral Centres (TRC) and 22 Remote Telemedicine Centres (RTC) in Odisha. The project is conceived as phase-III extension of the telemedicine network in Odisha. The project started in May 2010 under Build-Operate-Transfer (BOT) model. C-DAC has successfully completed the rollout phase of Odisha Telemedicine Network (Phase-III) program. The Mission Directorate, National Rural Health Mission, Government of Odisha has funded this program.

Inauguration and launch of Odisha Telemedicine Network (Phase III) was held on November 25, 2011, by Honorable Minister, Shri. Prasanna Acharya, Health & Family Welfare, Govt. of Odisha.

Telemedicine implementation at 10 Gram Panchayats: The project has been approved under the e-Panchayat Experimental Programme of Prime Minister Office (PMO). The project is being implemented by NIC, C-DAC, Mohali and District Administartion, Ajmer. Under the project Broadband application for Telemedicine (eSanjeevani) is to be provided for Panchyat Public Information Infrastructure and telemedicine facility in 10 Gram Panchayats of Ajmer District in Rajasthan. With the available medical equipment, the operator handing the telemedicine center will be able to refer the cases of the patients to the Medical College or Zanana Hospital at Ajmer. In turn, the doctor of the hospital will prescribe the medicine to the patient and, where required, call the patient to the District Hospital.

Uttar Pradesh: Telemedicine facility “eSanjeevani” was established at two stations, viz., Varanasi and Gazipur of M/S G. V. Meditech Pvt. Ltd. Varanasi hospital in Uttar Pradesh. Before establishment of the facility the hospital authorities arranged a health camp at Gazipur for the benefit of the rural poor population and also to advertise the telemedicine facility which was to be introduced by the hospital. This facility is likely to be extended to a number of other rural areas of the district after running it successfully for a reasonable period.

Chandigarh: Under the Medical Tourism programme, telemedicine software has been installed by M/S Doctor Z. India Health Care Pvt. Ltd. Chandigarh at two private hospitals viz Fortis Health Care and Ivy Hospital to attract patients from the overseas for undergoing treatment locally. This facility is likely to be extended to other hospitals and cities.

Technology Development for Building Distributed, Scalable, and Reliable Healthcare Information Store

C-DAC and Swedish Institute of Computer Science (SICS), Sweden, under the aegis of Department of Information Technology (DeitY), India and VINNOVA, Government of Sweden, respectively are developing a technology prototype for Distributed Health Store (DHS). After the research and analysis carried out last year, the work progressed towards developing various architectural components of DHS. Most of the components are now ready and final prototype is expected to be available for deployment around August-September 2012. Discussions are progressing to test the prototype at a few public hospitals.

The technology was showcased at the workshop on "Distributed ICT Infrastructure for Health: Step towards Integrated Digital Health Systems and Technology Preview" organized by C-DAC, in association with its partner and funding agencies, at Bengaluru on December 18, 2011.

"AROGYA ONLINE": Computerization of SMS Hospital, Jaipur and its Replication

Government of Rajasthan has taken the initiative to automate the Hospitals in the state to improve patient care. As per the scope of work RajCOMP formulated a work plan for the comprehensive computerization of SMS Hospital, Jaipur - a 2500+ bed tertiary care medical college hospital. The automation of the hospital covers all the services of the hospital including all patient centric services, administrative services and all back office services. With this automation, the patient gets a unique identification number (CR No.) and complete medical record of the patient is available online.

The customization and implementation of the HIMS was assigned to C-DAC. The software for the HIMS has been developed by C-DAC and customized for SMSH, Jaipur over the last two years. About 500 LAN nodes have been set up across 5 buildings of the Hospital towards Operationalisation of the HIMS which consisted of 28 modules. 'Arogya Online' is proposed to be replicated at all the Medical colleges and their associated hospitals across the State by Department of IT&C through RajCOMP

In this regard, tripartite MoUs was signed by RajCOMP, and C-DAC Noida with SMS Medical College, Dr. S. N. Medical College Jodhpur and RNT Medical College Udaipur to computerize works in SMS Medical College & associated Hospitals in the State for better Medicare. The model for computerization will be based on the successful model being used at the SMS Hospital, Jaipur.

Implementation of AHIMS on BOOT MODEL

C-DAC has implemented AHIMS Application in Guru Govind Singh Government Hospital (GGSGH), Delhi on BOOT (Build-own-operate-transfer) basis. BOOT Model is a form of project implementing process in which implementer finances everything including Hardware, Networking, Software, leased lines, Application hosting in Human Resources, etc. C-DAC undertakes to set up the complete HIMS solution at GGSGH in five stages, as listed below:-

Stage I: Site preparation, and installation and commissioning of all infrastructure needed at GGSGH.
Stage II : Rolling out all Phase I modules of HIMS, staffing required for Front desk and MRD modules and facility management required to ensure the Quality of Service.
Stage III: Rolling out all Phase II modules of HIMS
Stage IV: Full operational management of the system for a period of 60 months
Stage V: Transferring the entire Data along with HIMS software application and the hardware at GGSGH with all necessary documentation

Waiting Queue of patients for Registration (for female)

Project Submission and Management System for ICMR

C-DAC has developed a system for the Indian Council of Medical Research (ICMR), to manage their life cycle of funding medical research projects. The system supports processes for Online submission of project proposals, Evaluation of submitted proposals by experts, Project recommendations and Project Monitoring. The submission process supports one-stage and two-stage submissions. The development follows a BOOT model. The system is hosted as a Cloud Service in C-DAC data centre at Noida. The service can be used by other sponsoring agencies to manage their life cycle of funding development projects. Care has been taken to keep the design generic so that the service can cater to other life-cycles with minimal changes. ICMR started using the service since 1st January 2012, beginning with a two-stage submission.

Ayu-Shushrut

The Central Council for Research in Ayurveda & Siddha (CCRAS) is an autonomous body of the Department of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy), Ministry of Health Family Welfare, Government of India. CCRAS has approached C-DAC to implement a HIS System in all the 30 institute under it, so that same can be monitored from CCRAS Headquarter. C-DAC has proposed cloud based HIS Solution to CCRAS which will run from C-DAC Noida Data Center. As part of pilot it has been decided that Ayurveda Central Research Institute (ACRI), New Delhi will be taken for computerization. As per MOU, C-DAC has to provide 10 Clinical modules and 2 Backoffice Modules to CCRAS. Pilot project at ACRI is scheduled to be completed in 6 months time.

e-Aushadhi: Supply Chain Management Solution for Drugs on Cloud

The Government of Rajasthan has launched a scheme on 2nd October 2011 for providing free medicines to all patients under “Mukhya Mantri Nishulk Dawa Vitran Yojana” in all 33 Districts in Rajasthan. C-DAC has signed an MOU with Government of Rajasthan for providing a complete supply chain management solution for the Drugs under this scheme. C-DAC has developed the “e-Aushadhi” application, a web based application which deals with the Purchase of Drugs, Inventory Management of various drugs, sutures and surgical items and Distribution of Drugs etc to various District Drug Warehouses of Rajasthan, their sub stores like CSC and Primary Health Centres. Finally the drugs are issued to patient, the final consumer in the chain.

e-Aushadhi offers following features:

- Online Indenting from DDWH to Head Quarter
- Online Purchase Order generation to suppliers
- Provision to maintain expiry date / shelf life for an item wherever applicable
- Ability of online tracking of Drug Inventory in all Institutions.
- Various alert generation facility
- Provision to link all drug warehouses hierarchically to understand their physical as well as functional structure
- Inter Drug ware House Drug Transfer
- Integration with Arogya Online (HMIS application) in District Hospitals.

MHealth Project

C-DAC is developing an m-Health application with the following objectives

- To design, develop, and evaluate generic Body Area Network and a generic healthcare service platform for monitoring parameters such as ECG, EMG, Pulse rate, Respiration Rate, Skin Temperature, Blood Flow, and Saturated Percentage of Oxygen.
- To assess the suitability of mobile communications services available through public wireless networks in India for mHealth services for medical emergencies, patient transportation, managing chronic ailments, monitoring physiological parameters in the case of mobile subjects like sports persons.
- Research on methodologies to enhance acceptability of wireless public networks for mHealth applications.

Under this project, mobile computing platform is used to acquire patient data. The patient's physiological data is acquired wirelessly to the mobile. This data is then made available to the physician for suitable diagnosis and advice. Prototype wireless acquisition system and sensor interfaces are being tested for the system. Android based applications are also being developed for the project.

Deployment of Health Care Knowledge System in the North-East States for Promoting Public Health Awareness & Education

This project is sponsored by DeitY, under the North East Fund. Web enabled concept map based health care knowledge system will be used to promote health awareness & IT-enabled health education in all the eight North-East states of India. This provides faster Health knowledge acquisition & dissemination and effective at-a-glance understanding of symptoms, prevention, treatment, knowledge related to key-points to Stay-Healthy, Causes-Symptoms-Healing, Human Body's Organ Systems, Vitamins, Minerals, Diseases related to Cancer, Aging, Diabetes, Allergy, Burns, Malnutrition, Poisoning, etc. In the 1st phase (2011-12), the Health Care Knowledge System has been deployed in the following four NE States.

- Assam (Silchar Medical College & Hospital, Rural Health Centre at Ketlichara Block, Gauhati Medical College & Hospital)
- Tripura (Agartala Govt Medical College & Hospital, Mohanpur CSC, Tripura Medical College, IGM Hospital)
- Sikkim (Central Referral Hospital & Sikkim Manipal Institute of Medical Sciences, Tadong, Gangtok,, DHCHS&FW- Tashiling, Sikkim)

- Meghalaya (North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences, Mawdiangdiang, Shillong, DHS-Meghalaya).

Total 13 Health Care Knowledge Kiosks and 1 HCK PC have been set up across the above four NE states. The project has received wide acceptance among the common people, students and doctors in the North East States. In the second phase (2012-13), System will be deployed in four more NE States -Nagaland, Arunachal Pradesh, Manipur and Mizoram.

iCare@Home: Integrative and Holistic HealthCare Solutions @home

In line with the Millennium Development Goals set by the United Nations and the mandate of National Rural Health Mission's (NRHM), India C-DAC has developed iCare@home to empower households and even the rural populace having weak public health indices and infrastructure, with comprehensive knowledge of primary healthcare. iCare@home is a suite of Integrative healthcare informatics solutions with applications like risk predictor, symptoms analyzer and computer games. It is targeted to create health awareness among individuals and communities by Analysis, Prediction and Edutainment relating to holistic solutions for promotive health, disease prevention and primary care of diseases and symptoms.

iCare@Home introduces health games which are a perfect blend of health education and entertainment for varied age-groups. It contains following applications: Symptom Analyzer, Disease Risk Predictor, Health Games, Diet & Lifestyle, Home Remedies and Exhaustive Encyclopedia. iCare@Home was launched at the 25th Foundation Day of C-DAC by Hon. Minister Shri Sachin Pilot.

Health Informatics via Mobile Technology (HIMT)

HIMT is a suite of health applications developed using Mobile technology. Applications range from relatively easy health awareness applications to location based medical services. It is targeted towards mobile users to create health awareness and assist them to easily locate health services. Examples from around the world indicate a strong business case for mobile-based health applications.

The development of the suite has been completed. The applications encompass health assessment through calculators, health indices as well as applications designed specifically for health awareness. It also offers services for example, generate alerts through SMS to get immediate help in emergency condition. Some applications would create awareness within the society about disease out breaks as well as educate people about preventive measures that need to be adopted for a particular epidemic.

HIMT Suite currently encompass following applications

- Location Based Medical Services (Hospitals, Doctors, Medical Shops etc.)
- Emergency Services
  - Emergency Card, First Aid, and Blood Donor
- Primary care
- Yoga Advise
- Health Calculators (Ideal weight, BMI Calculator, Waist Hip ratio, Daily requirement of various nutrients, and Community Medicine)

Mobile Tele-Ophthalmology projects for Regional Institute of Ophthalmology

The system comprises a Tele ophthalmology system, setup at the Regional Institute of Ophthalmology, Thiruvananthapuram (RIOT) and a Mobile Tele ophthalmology Unit (MTO) named Sunayanam and Wi/Max connectivity for linking them. Telemedicine system at RIOT consists of a fully furnished environment with proper acoustics and electrical system, Computer Work Station with e-Nayana software, a High end Video Conferencing System, LCD TV, LAN facility, WiMAX and KSWAN Connectivity.

Sunayanam Mobile telemedicine Unit, built on a 9 metre long Tata 1613 BS2 Super Milo Chassis, houses a Computer with e-Nayana software, Video Conference System, LCD TV, Slit Lamp, Refraction Unit and the set up for vision testing, Indirect Ophthalmoscope, WiMAX Connectivity and the facility for connecting to the nearest KSWAN Centre. The Mobile unit is also provided with a 1.5 ton Split Air Conditioner, 5.5 KVA Generator, 3 KVA Online UPS, water tanks, and facility for drawing local power, if necessary. The setup enables RIOT to conduct medical camps at remote rural and tribal areas, examine patients and communicate via Video Conferencing, transfer the Electronic Health Record (EHR) of patients and provide expert consultation immediately using WiMax communication system at 512 KBPS bandwidth.

eNayana Tele Ophthalmology software helps create EHR of patients visiting the mobile van, which includes patient demographics and pictures of the anterior and posterior segment of the eye ball, captured using Slit Lamp provided in the mobile unit, and other relevant clinical and investigation details.

EDUCATION & TRAINING

Various post graduate diploma courses being offered by C-DAC and the enrollments during the year are as follows:

Name of the course	No. of students
DAC - Diploma In Advanced Computing	2803
WiMC - Diploma in Wireless and Mobile Computing	383
DVLSI - Diploma In VLSI Design	134
DESD - Diploma in Embedded Systems Design	93
DACA - Diploma in Advanced Computer Arts	58
DSSD - Diploma in System Software Design	83
DIVESD - Diploma in Integrated VLSI and Embedded System Design	218
DITISS - Diploma in IT Infrastructure Systems and Security	104

- Zip2Zenith Learning, Gurgaon has joined as an Authorized Training Centre
- A new course titled PG Diploma in Automation and SCADA Systems was initiated and one batch with 15 students was run successfully. The course had a unique blend of ICT subjects and the domain related subjects catering to the demanding nature of the work environment. This course is now ready to be offered in other centres of C-DAC

Corporate Training

C-DAC offers various specialized training programmes for corporate and organized sector.

- CID Pune: Trained 200+ participants on “Certificate Course in Cyber Security” Course.
- NRDMS (DST) Sponsored Training on Geoinformatics : Trained 25 participants on Faculty Development programme in Geoinfomatics

New Initiatives

IT Training Programme for Women Empowerment

To empower the women, DeitY has taken an initiative to offer job oriented training programmes. The objective of this scheme is to empower 700 women candidates for employment opportunities in IT.

Under this scheme, the training programmes have been designed to prepare the students for careers in Information Technology (IT), Business Process Outsourcing (BPO) and other IT enabled Services (ITeS). The training shall be conducted in seven states of India covering the states Uttar Pradesh, Madhya Pradesh, Jharkhand, Odisha, Chattisgarh, Rajasthan, and Bihar. The IT training shall be offered in four courses, with 100% fee waiver for the women candidates: Diploma in Business Computing (DBC), Advanced Diploma in Information Technology (ADIT), Diploma in Information Technology (ADIT), and Certificate Course in Web Designing

Free Career Oriented Coaching Scheme for Candidates belonging to Scheduled Caste for the state of Maharashtra

Dr. Babasaheb Ambedkar Research and Training Institute (BARTI), Pune (An autonomous institution working under the Department of Social Welfare Government of Maharashtra), National Commission of Scheduled Caste (NCSC), Maharashtra and Centre for

Development of Advanced Computing (C-DAC) is jointly offering 24 weeks full-time Post Graduate Diploma in Advanced Computing (DAC) programme to 300 candidates belonging to Scheduled Caste (SC) Category.

Capacity Building for IT Skill – Based Economically weaker Women & SHG members for Tripura District (South, North & Dhalai)
This project is funded by Govt of Tripura. The project is to impart job oriented computer based vocational IT training to women/SHG (Self Help Group) members of Tripura district. This project is about empowering the grass root people of Tripura District with IT Awareness Program and utilize them in local citizen Information Center as Service Provider which can be achieved by creating a pool of Master Trainers. These Master Trainers will be equipped with all the necessary skills to support to the local government in various sectors like Data Entry, Data Maintenance, Documentation, Hardware Maintenance, Maintenance of E-Governess activity, corporate training of govt. officials etc.

Capacity Building Training for Dhalai district is successfully completed. Master Trainers have been successfully developed and these trainers are now equipped with all the necessary IT skills to provide full e-governess related support to their local Government. As assured by local Govt., some of them have been already absorbed into various IT Based activities.

Inauguration of the Project with Workshop (Dhalai, Sponsor-Govt of Tripura)

Inauguration of the Project with Workshop (Agartala)

Resources, Facilitation Services and Initiatives

INTERNATIONAL COLLABORATIONS/COOPERATIONS

India – Tanzania Center of Excellence in Information and Communication Technology

Dr Manmohan Singh, the Hon'ble Prime Minister of India inaugurated the **India-Tanzania Centre of Excellence in ICT (ITCOEICT)** at Dar Es Salaam on May 27, 2011 in the presence of **H.E. Mr Jakaya Mrisho Kikwete,** the Hon'ble President of the United Republic of Tanzania.

The Centre will promote the development of Information and Communication Technology across the nation and shall help Government of Tanzania by way of capacity building in the areas of High Performance Computing and Applications like Weather Modelling, Computational Fluid Dynamics, Oceanography, Bio Informatics, Finite Element Analysis and Seismic Modelling.

Collaboration with KACST, Saudi Arabia

MoU signed with KACST (King Abdulaziz City for Science & Technology) for joint research & development in Open Source. The scope of the agreement include training to members from the KACST Saudi Arabia team on Libre Office tools, identifying needs for Arabic community in the existing Libre Office, Contribute to Libre Office foundation in fixing the reported bugs, and a feasibility plan for new localised distribution for Linux. As a first deliverable, we have trained the five members of the Saudi Team at C-DAC Chennai during March 12-23, 2012 on the Libre Office Architecture & tools which included C++/Java/Python refreshing sessions, Linux Basics, IDE, Version control, Bug tracking, Debian Package Management system, Localization, Libre Office architecture and components and Repository Management.

India – Armenia Centre of Excellence in Information and Communication Technology

C-DAC launched the "India – Armenia Centre of Excellence in Information and Communication Technology" at Yerevan, Armenia, on November 7, 2011. The opening ceremony was held at Yerevan State University in Indian tradition by lighting of the lamp jointly by the Hon'ble Prime Minister of Armenia Mr. Tigran Sargsyan and Shri. Sachin Pilot, Hon'ble Minister of State for Communications and IT, Govt of India.

The Centre of Excellence is a joint initiative between Govt of India and Govt of Armenia and is implemented by the Enterprise Incubator Foundation, Yerevan and C-DAC to establish a specialized infrastructure for delivery of ICT-related training and R&D programs.

Agreement between MEA and C-DAC for two years support to India – Ghana Kofi Annan Centre of Excellence in ICT at Accra

Government of India extends support to India – Ghana Kofi Annan Centre of Excellence in ICT at Accra, by two years.

India-Dominican Republic Centre for IT at Santiago

India – Dominican Republic Centre for IT (IDRCIT) at Santiago has been made operational on August 18, 2011 and has been inaugurated by Hon'ble President of Dominican Republic in the presence of dignitaries from India. Three experts from C-DAC have been deputed at site for training & operating the centre and now the IDRCIT is fully operational.

India - Seychelles Centre of Excellence in ICT at Mahe

India Seychelles Centre for Excellence in ICT was inaugurated on April 07, 2011 by H.E. James Michel, President of Seychelles

Setting up of India-Cambodia Centre of Excellence

MEA & C-DAC signed the agreement for setting up of India – Cambodia Centre of Excellence in Talent Development on March 15, 2012 at New Delhi. Under the project 10 Master Trainers will be trained in India in various different courses. C-DAC is also playing a supportive role initially for 6 months by deputing faculty members. Thereafter, the centre will be fully managed and run by the Government.

LEGAL AND INTELLECTUAL PROPERTY RIGHTS (IPR)

Patents Awarded

- "An Accelerator Pedal disconnection mechanism for vehicle speed limiter". Inventor: Shri. D. Krishna Warrier. Patent No: 2496937, dtd. 03.11.2011.
- "A device for measuring the vibration amplitude and frequency of a vibrating body without physical contact therewith". Inventors: Shri. R. Mohanachandran, R. Murali, and Rajesh K R. Patent No: 250216, dtd. 23.12.2011

Patents Filed

- "A Secure Programming Interface for Non Volatile Memory in an Embedded Device". Inventors: Thomas Joseph, Vipin R. L, Gopakumar G., S. Krishnakumar Rao, Biju C. Oommen, and R. Ravindra Kumar
- "Web based Rural Telemedicine Information System", jointly with Media Lab Asia. Inventors: R. Ravindra Kumar, Sudhamony S., Sudalaimani C., Binu P. J., and Vishal Mane
- "A Healthcare Management System for Performing all Healthcare Activities", jointly with Media Lab Asia. Inventors: R. Ravindra Kumar, ElizabethThomas T., Abey S. A., and Thara S. Pillai
- System and Method of Automated Fingerprint Image Quality Assessment, Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh
- "A Method to Authenticate Users in a Multi Server Environment", Inventors: Mohammed Misbahuddin, and Zia Saquib
- "Automated Analytical Tools for Images", Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh.
- "System and Method for Fingerprint Template Conversion", Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh
- "Non- Interactive, Dynamic and Secure Group Communication Scheme with Strong Authorization", Inventors: Om Pal, and Zia Saquib
- "Non- Interactive, Dynamic and Secure Group Communication Scheme on Polynomial Share", Inventors: Om Pal, Zia Saquib, and Ravi Batra
- "Non- Interactive, Dynamic, Computationally Efficient and Secure Group Communication Scheme", Inventors: Om Pal, and Zia Saquib
- "Method and System for Business Continuity and Disaster Recovery between a primary data centre and a secondary data centre with zero recovery point objective (zero RPO)", Inventors: Zia Saquib, Rekha Singhal, Shreya Bokare, and Prasad Pawar
- "A Robust Automated Fingerprint Identification System (AFIS) based on Cascaded Quality Checks and Multiple Feature Sets at Three Levels", Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh
- "Minutiae – based Fusion Matcher and Fingerprint Authentication System", Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh
- "System and Method for person recognition based on IRIS and Periocular Region", Inventors: Abhishekh Gangwar, Akansha Joshi, and Renu Sharma
- "A Two-factor Password-based Authentication Method for Web Users", Inventors: Mohammed Misbahuddin, P. Premchand, A. Goverdhan, and Zia Saquib
- "System and Method for segmentation of slap fingerprints", Inventors: Zia Saquib, Santosh Kumar Soni, Sweta Suharia, T.K.Varunkrishnan, Pratibha Mokal, and Anamika Singh

MoUs and MoAs

- C-DAC entered a Memorandum of Understanding (MoU) with Space Application Centre (SAC), ISRO on 21 February 2011 at SAC, Ahmedabad, for enhancing technology collaborations.
- C-DAC entered a Memorandum of Understanding (MoU) with VSSC, Trivandrum on 18 August 2011 at VSSC, Trivandrum.
- C-DAC entered a Memorandum of Understanding (MoU) with Open Source Drug Discovery (OSDD), CSIR on 15 November 2011 at JNU, Delhi

Signing of MoU with OSDD, CSIR at JNU, Delhi on 15 Nov. 2011 for GARUDA project

- M/s. ARDEE HI-TECH PVT LTD., Visakhapatanam signed MoA with C-DAC, Thiruvananthapuram for the "Design and development of a XRT Control System for Coal Sorting Machine" on May 28, 2011
- The Department of Health, Government of Kerala signed a MoA with C-DAC, Thiruvananthapuram for "Computerizing the Sree Avittom Thirunal Hospital (SATH), Thiruvananthapuram", under the Trivandrum Medical College on June 6, 2011
- M/s Bharat Earth Movers Ltd. (BEML), Belavadi, Mysore signed MoA with C-DAC, Thiruvananthapuram for the "Design and development of Advanced Unified Electronic Controller" on July 5, 2011
- M/s. Consul Consolidated (P) Ltd., Chennai signed MoA with C-DAC, Thiruvananthapuram for the Transfer of Technology of "Stand-alone OnLine Double Conversion UPS System", suitable for Medium/High Capacity Range applications on December 14, 2011
- M/s Jaipur Development Authority signed MoA with C-DAC, Thiruvananthapuram for the "Phase-III implementation of Traffic Control System for Jaipur City" on March 5, 2012
- M/s Dairy Development, Govt. of Kerala signed MoA with C-DAC, Thiruvananthapuram for "Systemization of Dairy Development Department, Kerala" on March 23, 2012
- District Hospital, Palakkad signed MOA with C-DAC, Thiruvananthapuram for "Implementing Mobile Tele-Ophthalmology Unit" on December 13, 2011
- MoU signed with National Botanical Research Institute for Setting up High Performance Computing facility for Bioinformatics Applications & Research. The HPC cluster will be utilized for porting of applications like Augustus, Genscan, Cap3, Pcap, Autosnp, Abyss, Circos, Mira, Repeatmasker and Vmatch.

AWARDS & RECOGNITIONS

- C-DAC Hyderabad received “eNorth East Award 2011” for the project titled “Model e-Villages in North East India” during the e-North East 2011 summit on November 25, 2011 at Kohima, Nagaland

eNorth East Award 2011” for the project titled “Model e-Villages in North East India”. The award was given by Shri Lalthara, Chief Secretary, Government of Nagaland, during the e-North East 2011 summit held on 25th November 2011 at Kohima, Nagaland.

- Research paper titled “Research and Implementation of Mobile Video Streaming Application for Ubiquitous Learning” won the “Best Paper Award” for the IEEE International Conference on Technology Enhanced Education (ICTEE-2012) conducted by Amrita University, Kerala, India during January 3-5, 2012

- Online Management, Monitoring and Accounting System for Pradhan Mantri Gram Sadak Yojana developed by C-DAC, Pune has been awarded the SKOCH Digital Inclusion Award - 2011 (e-governance).
- Central Power Research Institute (CPRI), Bangalore honoured C-DAC, Thiruvananthapuram with “Valued Customer Award in Sponsored Research & Development” for the year 2009-10. This award was presented to CDAC based on the successful implementation of a number of R&D projects, namely STATCOM for IT Park, DVR based Voltage Source Stabilizers for Process Industries, and Full Spectrum Simulator.
- mCARE – a mobile phone based Public Health Information System, developed by C-DAC, Thiruvananthapuram, was awarded Second Best mHealth Project in the public voting category, at eHealth World Awards 2011. The project, implemented at 120 health sub-centres, under 20 Primary Health Centres in 3 blocks of Tirur Taluk, covers a rural population of 7.5 lakhs in northern Kerala.
- Shri Sasi Pilacheri Meethal (Associate Director), C-DAC Thiruvananthapuram has been selected as the recipient of IEEE Communications Society’s award for Public service in the field of Telecommunications. Shri Sasi PM was selected for the award for his sustained contributions to low cost communication solutions for the masses and humanitarian needs. ShriSasi PM is the second recipient of this award from India, after Sam Pitroda, who received the award in 2007.

CONFERENCES, EVENTS ORGANIZED/PARTICIPATED AND TRAINING

Events organised

- State Level Workshop on Content and Outreach for Citizens Empowerment: Social Welfare and Rural Development conducted on 18th April 2011 at Hyderabad.
- A workshop on “India-EU ICT research collaboration opportunities in FP7 Call 8” at C-DAC, Pune on 29th April, 2011.
- Three days BOSS GNU/Linux Workshop for Promotion and campaign for BOSS Linux at Punjab University in April 2011.
- Workshop on IT for Masses developing roadmap for IT for Masses scheme at Shimla on May 3-4,2011
- Technology Showcase Event to showcase technologies developed by C-DAC Mohali and to envisage the opportunities for transfer of technology on May 9, 2011.
- Awareness Workshop for Electronics Industry Cluster, Mohali in collaboration with TIFAC, New Delhi For facilitating awareness on the technology gap analysis project at C-DAC Mohali on May 10, 2011
- Workshop on Cyber Security for Coordination & Organisation, Demonstrations of Honeynet System Seeking Future Research directions on 10 May, 2011.
- State Level Workshop on Content development for Social Welfare conducted on 13th May 2011, Trichy, Tamil Nadu.
- Workshop on “Emerging technologies for collaborative health care for the nation” at Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Lucknow during 13-14 May 2011.
- State Level Workshop on Content Generation for Agriculture & Primary Education conducted on 20th May 2011, Shantiniketan, Bolpur, West Bengal.
- Consultative meet on “Synergizing stakeholder efforts in Agricultural knowledge management - Role of India Development Gateway” on 20th May 2011, at Hyderabad.
- Brainstorming on Wireless Sensor Networks in Agriculture on 11th June, 2011 Hyderabad
- FOSS Forward – 2011, one day workshop on Open Source Technologies by C-DAC, Hyderabad in association with Computer Society of India on 18th June 2011 at Hyderabad
- National Workshop on Malware Threat & Defense on 20-21 June 2011.
- Consultative Meet on “Synergizing Stakeholders efforts on ICT for Rural Development in the states of Assam & Meghalaya - Role of InDG”, 24th June 2011, Indian Institute of Banking Management (IIBM), Guwahati, Assam
- One day seminar on “Privacy and Security in Online Social Media” on 23rd July 2011
- C-DAC e-Security R&D meet, 5-6 August 2011 at C-DAC, JNTU Campus, Hyderabad
- Blood Donation camp organized in collaboration with PGIMER, Chandigarh at C-DAC Mohali on August 10, 2011.
- Workshop on Monsoon variability, CAOS, DIVECHA CENTRE, Indian Institute of Science, Banglore 17 - 19 August, 2011.
- Coordinated a DST-RFBR sponsored Indo-Russian workshop on “Advanced Computational Modelling and Simulations”, ICAD, Moscow, September 19-22, 2011.
- A meeting of experts for Sanskrit language was convened at C-DAC, Pune on 4th November, 2011 under Chairmanship of Dr. Saroja Bhate.
- National Seminar on Doppler Radar and Weather Surveillance (DRaWS-2011), 17-18 November 2011, Hyderabad, India.
- Workshop on Proficient Project Management Practices for developing project management skills of C-DAC Mohali Staff Members at C-DAC Mohali on November 21-24, 2011
- Validation Workshop for facilitating the finalization of technology gap analysis project report for electronics industries cluster Mohali, sponsored by TIFAC New Delhi on December 1,2011
- C-DAC and BIS organized a one day National workshop on “e-Learning Standards – perceptions, opportunities, Practices” on 17th December 2011 at Hyderabad

- Workshop on Dev. Of Irrigation Scheduler Programmable Systems at Indian Agricultural Research Institute (IARI), New Delhi on 17 December, 2011.
- EUIndiaGrid2 workshop at Stockholm, Sweden, Dec 2011.
- Workshop on “Distributed ICT Infrastructure for Health: Step towards Integrated Digital Health Systems and Technology Preview”, Bengaluru, 18 December, 2011
- All India Calligraphy Art And Graphic Design Exhibition held At Lalit Kala Akademi, New Delhi From 30th December, 2011 to 05th January, 2012
- One day workshop “GEOVISION 2012” on the topic “New trends in GIS with special reference to Mobile GIS” on 28th January 2012
- Second WMO International Conference on Indian Ocean Tropical Cyclones and Climate Change, 14 - 17 February 2012, New Delhi – India.
- International conference on "Opportunities and Challenges in Monsoon Prediction in a Changing Climate" (OCHAMP-2012), 21-25 February 2012, Pune, India.
- Workshop on Open Source – Virtual Era on the occasion of National Science Day to promote BOSS Linux Operating System on Feb 28, 2012
- International meeting on Seamless Prediction System: Coupled modeling and Assimilation, 19 -21 March 2012, New Delhi, India.
- A one day consultation workshop with InDG partners organized on 28th January, 2012
- A three day workshop on “Mobile Application Development using J2ME and Android” was organized by School of IT, JNTUH and C-DAC Hyderabad during 15-17th March, 2012
- As a part of awareness campaign for usage of UNICODE standards in Marathi, training programme was organised for Employees from various departments of Government of Maharashtra. It was conducted through Video conference at Yashada, Pune which had a participation of 3000 users from metros and remote locations.
- Garuda Bootcamps have been organized at the following locations :
  - o Physical Research Laboratory, Ahmedabad (16-17 of Feb 2012)

  - o Variable Energy Cyclotron Centre, Kolkata (15-16 of Dec 2011)

- Garuda – NKN Partners' Meet was held in Bangalore on 15-16 of July 2011

- A technical school on Parallel computing called the "Think Parallel" – was conducted for academicians from various colleges and universities across India (02-12 Jan 2012)

- Garuda Technical Presentations and handholding of Partnering institutions have been conducted in the following locations:
  - Physical Research Laboratory, Ahmedabad
  - Malviya National Institute of Technology, Jaipur
  - IIIT, Hyderabad
  - NIT, Surathkal
  - CCMB, Hyderabad
  - IITR, Lucknow
  - IIST, Trivandrum
  - CRRI, Cuttack
  - NML, Jamshedpur
  - NIT, Tiruchirapalli
  - Central Universtiy of Karnataka, Gulbarga

- NBRI, Lucknow
- IIIT, Delhi

- SCADA Security Awareness Programme was organized at the Forum of Load Despatchers (FOLD) at Power Grid, New Delhi on 10th February 2012.

- CHAIN/EU-IndiaGrid2/EPIKH School for Grid Site Administrators at VECC Kolkatta, in Feb 2011
- Advanced School on HPC and Grid Computing at ICTP, Italy in April 2011.
- International Symposium on Grids and Clouds (ISGC) 2012 at Academia Sinica in Taipei, Taiwan from 26 February to 2 March 2012
- EU-India Grid2 Final Review Meeting at Brussels, Belgium in March 2012 by Dr. Sarat Chandra Babu, Executive Director C-DAC Bangalore.

Event participation

- Participated in IT.Biz, 2011 held at Bangalore from Oct 18-20, 2011. Showcased latest offerings from GIST like Rajbhasha Reporting Software, Localization suite and software development tools.
- Participated in the TOLIC meet organized by Central Power Research Institute, Bangalore. Showcased ISM V6 and Rajbhasha Reporting Software. Participants were from Central Govt departments in Bangalore.
- An international conference on “ICT-IPR Trends and Challenges in Globalised World” was held on 21st April 2011 at the India Habitat Centre, New Delhi. This was a huge success with more than 120 members attending the same.
- Participated in 15th National Conference on e-Governance at Bhubaneshwar. C-DAC has demonstrated various Indian language Tools and Technologies.
- IDN GTLD conference held on the following dates and locations:
  - 06th July, 2011 at India Habitat Centre, Delhi
  - 14th July, 2011 at Hotel Mascot, Thiruvananthapuram
  - 21-22nd July, 2011 at Yashada, Pune
  - 19th August, 2011 at HICC, Hyderabad
  - 23rd August, 2011 at C-DAC, Thiruvananthapuram
  - 16th September, 2011 at C-DAC, Pune
  - 14th October, 2011 at India Habitat Centre, Delhi

- 28th November, 2011 at Hotel Capitol, Bangalore
- 01st December, 2011 at C-DAC, Pune
- 05th December, 2011 at Hotel Swosti Premium, Bhubaneswar
- 08th December, 2011 at C-DAC, Pune

- APRICOT 2012 Conference held in New Delhi from 21st to 27th February, 2012; The mission of the Asia Pacific Regional Internet Conference on Operational Technologies (APRICOT) is to provide a forum for those key Internet builders in the region to learn from their peers and other leaders in the Internet community from around the world.
- Kamal Pathak and Chandrakant P Dhutadmal presented the work on "Localisation Project Management Framework" being undertaken at C-DAC in 16th Annual LRC Internationalisation & Localisation Conference & 3rd Multilingual Web Workshop, held during 21-23 September 2011at Limerick, Ireland.
- C-DAC Thiruvananthapuram participated in the Hannover Messe 2011 held during 4-8 April, in Germany. Hannover Messe is the world's largest Industrial Automation exhibition.
- A round table meeting of weather and climate modeling experts Prof. Sulochana Gadgil, IISc, CMMACS, IISc, TIFR, NCMRWF participated - Feb. 18, 2011
- UbiComp India 2011- Feb. 26, 2011
- Indian Smart grid – Premise & Perspective - March 11, 2011 - Jointly with Intel
- GGOA workshop - March 17-18, 2011
- Multicore & GPGPU workshop - C-DAC CUDA training centre (CCTC) - May 2011
- National Workshop on Cloud Computing - May 21, 2011
- Workshop on "Computational Electromagnetic and Application (CEM) - June 14-17, 2011
- Workshop on Android and its applications - May 26-27, 2011
- Round table meeting on ICT requirements for Kannada - June 6, 2011
- National Workshop on online resources for Vedic and Manuscript Processing, June 20, 2011
- National workshop on "Online Resources for Vedic and Manuscript processing" on 20/06/2011
- Practical workshop on Vedic and Sanskrit applications from 16/01/2012 to 18/01/2012.
- Workshop on Android Applications Development – 26-27 May, 2011
- User Awareness program for e-resources such as e-books and e-journals - Nov. 22, 2011
- Demonstrated GAP2.0 and GSRM 1.0 at Open Tech Session on Grid-HPC-Cloud
- Demonstration of GAP and GSRM at Think Parallel All india Teachers Training program at C-DAC KP and Bangalore (Jan 2012) and IT.Biz, Bangalore, Nov 2011
- C-DAC, Noida took initiative to publish Annual Hindi Magazine 'Abhivayakti' in 2009. The third edition of Annual Hindi Magazine 'Abhivayakti' comprising of 98 pages was published. Over the years, the Magazine has contributed immensely in popularizing of the use of Official Language Hindi.

Training

- Under funding from Ministry of External Affairs C-DAC has trained around 40 candidates from different African countries.
- GIST PACE during financial year 2011-12, has trained approx. 31000 students on various basic level computer courses, covering aspects of multilingual computing and solutions along with the existing market technologies.
- Capacity Building for IT Skill – Based Economically Weaker Women / SHG's / Local Youths for Purba Medinipur District of West Bengal. Training of 80 numbers Master Trainer completed and another 100 is ongoing.
- During April 2011 to March 2012, 142 ISEA workshops were conducted across the country along with participating institutes like C-DAC Mohali, C-DAC Kolkata, C-DAC Bangalore, C-DAC Delhi, C-DAC Pune, NIELT Gorakpur, NIELT Aizwal, NIELT Jammu, NIELT Gangtok, NIT Suratkal, Goa Engineering College, Dr.Ambedkar College of IT Jalandar, IIT Guwahathi etc.
- Advanced Faculty Training in Emerging trends of Hardware, Embedded Systems and Information Technology, for engineering college faculty. During Apr 2011 – Mar 2012, 217 faculty members from 15 states in India were trained through seven 2-week training programs.
- 56 students enrolled for C-DAC Certified Cyber Security Professional (CCCSP) online course.
- 403 students enrolled for DAC, DESD, DSSD, DABC, CNSS and ACB courses.
- A training on "Open Source Compliance Programme" was conducted on January 4th 2012 for "Visteon Technical and Services Center Private Ltd"
- One week training program on "e-Suraksha" – a practical approach in Network Security" was conducted to DRDO scientists in two batches during 5th – 9th December 2011 and 30th January – 3rd February 2012.
- Two week training programmes on Mobile Application Development and Linux System and Multicore Programming during 21st Nov 2011 – 2nd Dec 2011
- Two week training programmes on Hands-on with ARM: Programming Embedded Systems and Security Engineering during 12th Dec 2011 – 23rd Dec 2011
- Two week training programmes conducted on Enterprise Solutions for Web Applications and Parallel programming for scientists and engineers during 2nd Jan 2012 – 13th Jan 2012
- Two week training programme was conducted on Electronic Product Design and Productivity Technology during 23rd Jan – 3rd Feb 2012
- Two-week training program is organized to SAC (Space Application Center) officers at Ahmedabad on network security during Feb 13th -17th 2012 and 9 – 13th April, 2012
- 3-day course on "Advances in Electrical Power Systems" was conducted by IIT Mumbai from September 14-16 at C-DAC-KP-Bangalore.
- Training program on HPC & Parallel computing- January 04, 2011
- Train the trainer workshop - January 28, 2011
- Train the Trainers workshop on Information Security Awareness- January 28, 2011
- Coding for C training - March, 2011
- This year the intake to various courses were increased to 300 per batch. The placement has been very good and companies like Wipro, Xerox, Sasken, C-DAC, Cisco, Seimens, Capgemini and many more visited the centre. On the whole over 80% of the eligible candidates got placed from the two batches conducted during the year.
- A new course titled PG Diploma in Automation and SCADA Systems was initiated and one batch with 15 students was run successfully. The course had a unique blend of ICT subjects and the domain related subjects catering to the demanding nature of the work environment. This course is now ready to be offered in other centres of C-DAC
- Several corporate training programs conducted to address the specific needs of the industry in advanced areas like Verilog, FPGA, RT Linux, Embedded Systems, etc. Over 200 people were trained under this program.
- Diploma in Automation and SCADA Systems (DASS) conducted under ACTS

Visitors

- Visit of Sh. A.K. Balani, Director-EGov, DIT at C-DAC, Pune on 28th December, 2011
- Dr. Shashi Tharoor, Hon'ble Member of Parliament and former Minister of State for External Affairs, visited the C-DAC Thiruvananthapuram on 13th July, 2011

- Shri Rajarshi Bhattacharya, IAS, Additional Secretary & Financial Adviser, DIT, MCIT, Government of India, visited the C-DAC Bangalore (KP) on 13th January 2011
- Mr. Jagadish Chander, DST, visited the C-DAC Bangalore (KP) on 5th January 2011
- Shri Ravi Shanker N, IAS, Joint Secretary, DIT, MCIT, Government of India visited the C-DAC Bangalore (KP) on 8th January 2011
- Shri V.S. Mahalingam, Director, CAIR visited the C-DAC Bangalore (KP) on 3rd February 2011
- Prof. Manimaran, IOWA visited the C-DAC Bangalore (KP) on 13th December 2011
- Dr. Vijay Bhatkar visited the C-DAC Bangalore (KP) on 26th December 2011
- A 10 member Kazak delegation comprising of Directors and heads of various govt. Departments and Ministries visited C-DAC, Noida on 26.3.2012 for exploring bilateral co-operation in Research and training projects.

- A high level delegation led by H.E. Mr. Nguyen Thien Nhan, Dy. Prime Minister of Vietnam visited C-DAC, Noida on 28.3.2012, to explore the possibility of strengthening mutual cooperation in proliferating ICT applications in Vietnam. The visit was in the backdrop of the ICT projects C-DAC executed in Vietnam in the past.

H.E. Mr. Nguyen Thien Nhan, Dy. Prime Minister, Vietnam exchanging views with C-DAC officials

INVITED TALKS

- Shri R Mohanachandran delivered a session on Vehicle Mountable Acoustic Landmine Detection System at Golden Jubilee Symposium of R&DE (Engrs), Pune, on the theme “Robotics and Autonomous Vehicles-views and perspectives” on 28-29th April, 2011
- Shri A. Saravana Kumar delivered a lecture on “Power Quality issues at IT Park-Active Filter Solution” at “Power System Optimization Techniques” conducted by Adhiparasakthi Engineering College, Chennai on 10th June, 2011
- Smt KA Fathima and Shri V.Muralidharan delivered a talk on “Possibilities of Electronics R&D and applications in the North East” at One day meet amongst the stakeholders organized by DeitY Delhi and Tezpur University, Tezpur, Assam on 29th July, 2011
- Shri. Satheesh Kumar S. delivered a session on “Cyber Forensics" in the Workshop jointly organized by CERT-Kerala and IMG, Kerala on 2nd August 2011
- Shri. Bhadran V. K. delivered a talk on “Use of Cyber Forensics in Cyber Warfare" at Workshop on Cyber Warfare organized by Military College of Telecommunication Engineering (MCTE), Mhow on 11th August 2011
- Shri.Bhadran V. K. delivered a session on "Cyber Forensics" at Faculty Development Programme for M. Tech students of Computer Forensics at JSS College of Engineering, Bangalore on 27th August 2011
- Shri. B. Ramani, Shri. Bhadran V. K. and Shri. K. L. Thomas delivered a session on “Role of Cyber Forensics in Cyber Security of Government” at SMAC (Subsidiary Multi Agency Centre) meeting at SIB (Subsidiary Intelligence Bureau), Thiruvananthapuram on 19th October 2011
- Shri. Bhadran V. K. delivered a talk on "Cyber Forensics - Issues and Challenges" at Training programme conducted by Administrative Staff College, University of Kerala, Karyavattom on 21st October 2011
- Shri. Bhadran V. K. delivered a session on "Cyber Security & Forensics" at Govt. Engineering College, Sreekrishnapuram, Palakkad. on 28th November 2011
- Shri. Nabeel Koya A delivered a series of talks on “Digital Signatures and Cryptography” and “Public Key Infrastructure“ for System Administrators of Kerala Government organized by IMG, Kerala
- Shri. S. Krishnakumar Rao delivered a talk on “IP Core Design and Deployment--CDAC initiatives” at The International Conference on Field Programmable Technology 2011 at IIT Delhi on 12th -14th December 2011
- Shri. V. Muralidharan delivered a talk on “Showcasing indigenous ITS solutions and next generation Traffic Control System” at 2nd Annual Intelligent Transportation Systems India conference, New Delhi on 27-28th February 2012
- Shri. R. Ravindra Kumar delivered a talk on “Technology for Hearing Impairment with special reference to deployment in North-East India” at National Workshop on Hearing Handicapped with special focus on North-Eastern States, held at Mumbai on 28th March 2012
- Shri. Vineeth delivered a talk on “Grid can co-exist with Cloud in GARUDA” at VIT Vellore on April 2012
- Dr. Prahalad Rao delivered a keynote talk on “Cloud Computing: a new revolution in IT” at National Conference on VLSI, SP and Communications - NCVSComs12 at Vignan Engg College, Guntur on 10th February 2012.
- Dr. Prahlada Rao delivered a session on “GARUDA” at International conference GlobusWORLD 2011, ANL Chicago IL-USA on 11-13 April, 2011.
- Shri S P Dixit delivered a talk on “HPC Future Trends” on 18 April, 2011

RESEARCH PAPERS PUBLISHED / PRESENTED

- Kumar Mandula, Srinivasa Rao Meda, Dhanander Kumar Jain and Radhika Kambham, "Implementation of Ubiquitous Learning using Mobile and Sensor Technologies", IEEE International Conference on Technology for Education (T4E-2011), IIT-Madras, Chennai, July 14-16, 2011
- Ramu Parupalli, Sarat Chandra Babu Nelaturu and Dhanander Kumar Jain, "The Role of Content Adaptation in Ubiquitous Learning", IEEE International Conference on Technology for Education (T4E-2011), IIT-Madras, Chennai, July 14-16, 2011
- Kumar Mandula, Srinivasa Rao Meda and Dhanander Kumar Jain, "Research and Implementation of a Mobile Video Streaming Application for Ubiquitous Learning", IEEE International Conference on Technology Enhanced Education (ICTEE-2012), Amrita University, Kollam, Kerala, India, January 3-5, 2012
- Uday Kumar, Mamatha J, Sandesh Jain and Dhanander K Jain, "Intelligent Online Assessment Methodology", 7th International Conference on Next Generation Web Services and Practices (NWeSP),Salamanca, Spain, October 19-21, 2011
- Uday Kumar, Mamatha J, Sandesh Jain and Dhanander K Jain, "Learning Styles and Knowledge Based Personalized Online Learning Services", 10th IADIS International Conference on WWW/Internet 2011
- Mohit Malhotra, DSR Praveen Varma, Pramod P J and Dhanander Kumar Jain, "Stream Track: A Tool for QoS Monitoring of Multimedia Sessions", 6th International Conference on Telecommunication Systems, Services, and Applications (TSSA), Bali, Indonesia, October 2011
- Ankith Agarwal, Pramod P. J and Dhanander K Jain, "Design and Implementation of IEEE 802.21 based Media Independent Handover Services", APAN-NRW 2011
- Tarantula, Sandeep Romana, Swapnil Phadnis and Himanshu Pareek, "Behavioral malware detection expert system", 4th International Conference on Network Security and Applications, Chennai, India, July 2011
- Jyostna Grandhi, Himanshu Pareek and P R L Eswari, "Detecting Anomalous Application Behaviors using a System Call Clustering Method over Critical Resources", 4th International Conference on Network Security and Applications, Chennai, India, July 2011
- N Sarat Chandra Babu, N. Satyanarayana, Sandesh Jain, Vaibhav Sharma, Vikas Garg, A P Rajshekar and Vikas Rangi, "Quality Analytics Framework for E-Learning Application Environment", International Conference on Technology for Education, 2012
- Singh Jaspal, Divya and Lalit, "Implementation of Greenhouse environment monitoring system using Zigbee based adhoc network", CIIT international journal of wireless communication, Vol 3, No. 9, 2011
- Rekha devi and Mandeep Singh, "VHDL Implementation of GCD processor with Built in Self test feature", International Journal of Computer Applications, Vol 25, No. 2
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- Dilip Kumar, "Multi-Hop Communication Routing (MCR) Protocol for Heterogeneous Wireless Sensor Networks", International Journal Information Technology, Comm. and Convergence, 2011, Vol. 1, No. 2
- Dilip Kumar, "EECDA: Energy-efficient Clustering and Data Aggregation Protocol For Heterogeneous Wireless Sensor Networks", International Journal of Computers, Communication and Control, Romania, 2011, Vol. 06, No. 1
- Mohandeep Sharma and Dilip Kumar, "Wishbone Bus Architecture – A Survey and Comparison", International Journal of VLSI Design and & Communication System, 2012

- Karishma Bajaj, Manjit Kaur and Gurmohan Singh, “Design and Analysis of Hybrid CMOS SRAM Sense Amplifier”, International Journal of Electronics and Computer Science Engg., 2012, Vol. 1, No. 2
- Tapsi Singh, Manjit Kaur, Gurmohan Singh, Design and Analysis of CMOS Folded Cascode OTA Using Gm/ID Technique, 2012, International Journal of Electronics and Computer Science Engineering, Vol. 1, No. 2
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- Ramesh Naidu Laveti, Janakairaman S, Mohit Ved and B.B. Prahlada Rao, "Seasonal Forecast Modeling application on GARUDA Grid Infrastructure", International Symposium for Grids and Clouds (ISGC-2012), Taipei, 26th Feb - 2nd March, 2012
- R. Manavalan, Subrata Chattopadhyay, Mangala, Sundararajan and Kishor Gupta, “Grid Based Virtual Visualization & web services model”, International Conference on Network and Computer Science (ICNCS), Kanyakumari, 8-10th April 2011
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GarudaGrid", PSG College of Tech, Coimbatore PLMSS-11, 5-7 December 2011

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- Preeti Malakar, Vijay Natarajan and Sathish Vadhiyar, "An Integrated Steering Framework for Critical Climate Applications", International Conference on Computational Science (ICCS), Singapore
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- V. Yesubabu, C.V.Srinivas, S.S.V.S. Ramakrishna and Akshara K, "Impact of variational data assimilation in simulation of Tropical Cyclones over Bay of Bengal during 2005-2011", 6th East Asia WRF Workshop and tutorial, Seoul, South Korea, April 16-17, 2012
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- Rastogi R., Khonde K. and Srivastava, “A HPC challenges in Traveltime calculation for 3D Prestack Kirchhoff Depth Migration”, DST-RFBR Russian-Indian workshop on “Advanced Computational Modeling and Simulations”, Moscow, Russia, September 19-23, 2011
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- Chandra Bhushan Roy, Supriyo Paul, and Vikas Kumar, "Development of Computational Fluid Dynamics Applications on Garuda Grid", International Conference on Trends in Product Life Cycle, Modelling, Simulation, and Synthesis, PSG college of Technology, Coimbatore, India, December 5 - 7, 2011
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- K. Joshil Raj, Vidyavati S. Nayak and Valadi K. Jayaraman, “Ant-Miner Based Intrusion Detection System with Various Feature Selection Algorithms”, Fifth Indian International Conference on Artificial Intelligence, Tumkur, India, Dec 14-16, 2011
- V.K. Jayaraman, “Hybrid Machine Learning-Evolutionary Computing Techniques for Simultaneous Binding Site Prediction and Informative Feature Extraction”, Conference on Informative and Integrative Biology, Bose Institute, Kolkata, 2011
- Shimantika Sharma, Shameek Ghosh, Narayanan Anantharaman and Valadi K. Jayaraman, “Simultaneous Informative Gene Extraction and Cancer Classification Using ACO-AntMiner and ACO-Random Forests”, International Conference on Information Systems Design and Intelligent Applications 2012 (INDIA 2012), Visakhapatnam, India, January 2012.
- V.K. Jayaraman, “Hybrid artificial intelligence and machine learning methodologies for structure based prediction of ligand binding sites”, International Conference on Mathematical and Theoretical Biology, IISER, Pune, January 23-27, 2012
- Akshay Yadav and V K Jayaraman, “Random forest based identification of proteins using fragment library frequency vectors”, International Conference on Mathematical and Theoretical Biology, IISER, Pune, January 23-27, 2012
- Akshay Yadav, V K Jayaraman, Mohan Kale and Urmila Kulkarni-Kale, “Phylogenetic clustering of protein sequences using Recurrence Quantification Analysis”, Bifx12 virtual conference, March 1-2, 2012
- Sonali Chavan, Kiran Kadam and V. K. Jayaraman, "Identification of bacterial lipoproteins by machine learning methods", Accelerating Biology 2012 (Computing to Decipher), February 15-17, 2012
- Venkatesh Shenoi, “Flat Histogram methods: Parallelization approach and Applications”, International Conference on Mathematical and Theoretical Biology, IISER, Pune, January 23 -27, 2012

- Venkatesh Shenoi, “Soft Matter Simulations on HPC platform”, Symposium on HPC applications, IIT Kanpur, March 12-14, 2012
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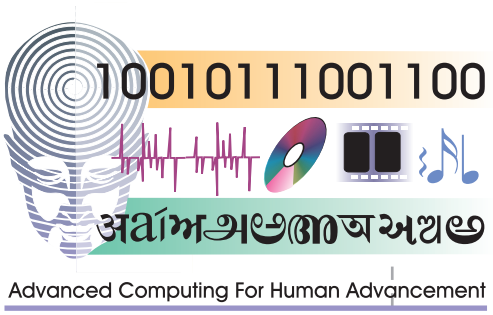
Shri Sachin Pilot, Hon'ble Minister of State for Communications and IT, Govt of India lights the inaugural lamp during the 25th Foundation Day of C-DAC at Pune in the presence of Smt Humeera Ahmed, Post Master General, Dept of Posts (West), Prof Rajat Moona, Director General, C-DAC, Shri R Bhattacharya, Additional Secretary & Financial Adviser, DeitY, Ministry of Communications and IT, Govt of India, Dr Hemant Darbari, Executive Director, C-DAC, Pune and Prof Devang Khakhar, Director, IIT Bombay

Shri J Satyanarayana, Secretary, DeitY, Ministry of Communications and IT, Govt of India with Prof Rajat Moona, Director General, C-DAC, Dr Hemant Darbari, Executive Director, C-DAC, Pune and senior members of C-DAC, Pune at the Bioinformatics Resources and Applications Facility (BRAF) during his visit to C-DAC, Pune.



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