Executive Committee (2015-16/17)

President
Prof. Bipin V. Mehta
president@csi-india.org

Vice-President
Dr. Anirban Basu
vp@csi-india.org

Hon. Secretary
Mr. Sanjay Mohapatra
secretary@csi-india.org

Hon. Treasurer
Mr. R. K. Vyas
treasurer@csi-india.org

Immd. Past President
Mr. H. R. Mohan
ipp@csi-india.org

Nomination Committee (2015-2016)

<table>
<thead>
<tr>
<th>Region</th>
<th>Nominees</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region - I</td>
<td>Dr. Devaprasanna Sinha</td>
<td><a href="mailto:rvp1@csi-india.org">rvp1@csi-india.org</a></td>
</tr>
<tr>
<td>Region - II</td>
<td>Mr. Raju L. Kanchibhotla</td>
<td><a href="mailto:rvp2@csi-india.org">rvp2@csi-india.org</a></td>
</tr>
<tr>
<td>Region - III</td>
<td>Dr. Srikrishna S. Sane</td>
<td><a href="mailto:rvp3@csi-india.org">rvp3@csi-india.org</a></td>
</tr>
<tr>
<td>Region - IV</td>
<td>Mr. Hari Shankar Mishra</td>
<td><a href="mailto:rvp4@csi-india.org">rvp4@csi-india.org</a></td>
</tr>
</tbody>
</table>

Regional Vice-Presidents

<table>
<thead>
<tr>
<th>Region</th>
<th>Chairperson</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region - I</td>
<td>Mr. Shiv Kumar</td>
<td><a href="mailto:rvp1@csi-india.org">rvp1@csi-india.org</a></td>
</tr>
<tr>
<td>Region - II</td>
<td>Mr. Devaprasanna Sinha</td>
<td><a href="mailto:rvp2@csi-india.org">rvp2@csi-india.org</a></td>
</tr>
<tr>
<td>Region - III</td>
<td>Dr. Srikrishna S. Sane</td>
<td><a href="mailto:rvp3@csi-india.org">rvp3@csi-india.org</a></td>
</tr>
<tr>
<td>Region - IV</td>
<td>Mr. Hari Shankar Mishra</td>
<td><a href="mailto:rvp4@csi-india.org">rvp4@csi-india.org</a></td>
</tr>
</tbody>
</table>

Division Chairpersons

<table>
<thead>
<tr>
<th>Division</th>
<th>Chairperson</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division-I : Hardware (2015-17)</td>
<td>Prof. M. N. Hoda</td>
<td><a href="mailto:div1@csi-india.org">div1@csi-india.org</a></td>
</tr>
<tr>
<td>Division-II : Software (2014-16)</td>
<td>Dr. R. Nadarajan</td>
<td><a href="mailto:div2@csi-india.org">div2@csi-india.org</a></td>
</tr>
<tr>
<td>Division-III : Applications (2015-17)</td>
<td>Dr. Ravikiran Mankikar</td>
<td><a href="mailto:div3@csi-india.org">div3@csi-india.org</a></td>
</tr>
<tr>
<td>Division-IV : Communications (2014-16)</td>
<td>Dr. Durgesh Kumar Mishra</td>
<td><a href="mailto:div4@csi-india.org">div4@csi-india.org</a></td>
</tr>
<tr>
<td>Division-V : Education and Research (2015-17)</td>
<td>Dr. Suresh Chandra Satapathy</td>
<td><a href="mailto:div5@csi-india.org">div5@csi-india.org</a></td>
</tr>
</tbody>
</table>

Important Contact Details

For queries, correspondence regarding Membership, contact helpdesk@csi-india.org

CSI Communications | January 2016 | 2

www.csi-india.org
Contents

Volume No. 39 • Issue No. 10 • January 2016

Cover Story
9 MongoDB - An Open Source NoSQL DB by R. Sasikala
11 Open Source Software Versus Commercial Software by Noopur Goel
13 Shaping the Future of Technology using Open Source Software by Arzoo Dahiya
14 Software Agent Integrated Open Source SaaS Cloud: A Contributor in Digital India Initiative by Md. Shams Raza

Technical Trends
17 Lab of Things (LoT) by A. Jameer Basha
19 Wearables and Social Media - The Future is here! by Sowmya Togarcheti and Nataraj Sirisilla

Research Front

Articles
26 Write Your Own Program: Demystifying Computer Programming for Amateurs by Subrata Ganguli and Dhrubjyoti Sharma
29 Determining Maturity Level of a BI (Business Intelligence) Application by Manish Kumar and Ranjan Sarangi

Security Corner
36 Overcoming the Privacy Problem of the Aadhaar Database by Prem Agrawal
37 Securing the WEB, Once and for all– Let’s Encrypt by Richa Garg and Satish Kumar Selvaraj

PLUS

Brain Teaser
39

Lifetime Achievement Awardees Citations
40

CSI Reports
45

Student Branches News
49

Please note:
CSI Communications is published by Computer Society of India, a non-profit organization. Views and opinions expressed in the CSI Communications are those of individual authors, contributors and advertisers and they may differ from policies and official statements of CSI. These should not be construed as legal or professional advice. The CSI, the publisher, the editors and the contributors are not responsible for any decisions taken by readers on the basis of these views and opinions.

Although every care is being taken to ensure genuineness of the writings in this publication, CSI Communications does not attest to the originality of the respective authors’ content. © 2012 CSI. All rights reserved.

Instructors are permitted to photocopy isolated articles for non-commercial classroom use without fee. For any other copying, reprint or republication, permission must be obtained in writing from the Society. Copying for other than personal use or internal reference, or of articles or columns not owned by the Society without explicit permission of the Society or the copyright owner is strictly prohibited.

Complaints of non-receipt of CSIC may be communicated to Mr. Ashish Pawar, 022-29261724, ashish@csi-india.org, indicating name, membership no, validity of membership (other than life members), complete postal address with pin code and contact no.
Dear Fellow CSI Members,

Open Source Software is the software developed by volunteers/communities. Software Developers develop programs as per their requirement, source code is open to all and anyone can improve the software by providing inputs and/or fixing bugs, modifying as per new requirements. The code generated is of high quality because many experts from different fields are involved. Some very popular open source software are Perl programming language, GNU/Linux operating system, Apache server software etc. The main concept of open source software approach is open collaboration.

Keeping in mind, the importance of open source concept, the publication committee of Computer Society of India selected the theme of CSI Communications (The Knowledge Digest for IT Community) January 2016 issue as “Open Source Software”.

The first cover story included in this issue “MongoDB - An Open Source NoSQL DB” by R. Sasikala discusses the features, installation steps, basic working style, research areas related to MongoDB open source Database system. In next cover story “Open Source Software Versus Commercial Software”, N. Goel compares the open source software model with commercial software model. In cover story “Shaping the Future of Technology using Open Source Software” by A. Dahiyaa focuses on the prospects of applying open source software in education, business etc. Last cover story “Software Agent Integrated Open Source SaaS Cloud: A Contributor in Digital India Initiative” by Md. S. Raza provides a mechanism that will help various agencies to develop innovative software and share with uniformity with minimum financial burden.

In Technical Trends category, “Lab of Things (LoT)” by A. J. Basha presents a mechanism of using various common devices for useful applications. Next article in this category is “Wearables and Social Media - The Future is here!” by S. Togarcheti and N. Sirisilla that describes an interesting technology that may change the way services are provided and consumed across sectors.

Article “Determining Maturity Level of a BI (Business Intelligence) Application” by M. Kumar and R. Sarangi suggests an evaluation mechanism to determine the level of maturity for a BI product or application by doing assessment with respect to modern day computing. Next article “Write Your Own Program: Demystifying Computer Programming for Amateurs” by S. Ganguli and D. Sharma gives an approach of writing computer programs.

In Security Corner, we have included “Overcoming the Privacy Problem of the Aadhaar Database” by P. Agrawal that discusses a way to ensure consistency of personal data held by multiple entities and reduces the effort of providing data to a new entity, while maintaining the privacy of a person’s personal data. Next article in this category “Securing the WEB, Once and for all- Let’s Encrypt” by R. Garg and S. K. Selvaraj describes various aspects of the project “Let’s Encrypt”.

This issue also contains an Interview on Open Source Technologies of Prof. Raj Kumar Buyya, Director, CLOUDS, University of Melbourne, Australia taken by S. Rampur, Chairman CSI Mysuru Chapter.

This issue also contains CSI 2015 (Golden Jubilee Convention) report, Citations of Life time achievement awardees, Crossword, CSI activity reports from divisions, chapters, SIGs, student branches and Calendar of events.

I take this opportunity to express my sincere thanks to Dr. Vipin Tyagi, Guest Editor, for bringing this issue successfully. I extend my gratitude to the entire ExecCom and Publication Committee for their continuous support in bringing this issue successfully.

The new issue of CSI Adhyayan is also available on CSI portal.

On behalf of publication committee, I wish to express my sincere gratitude to all authors and reviewers for their contributions and support to this issue.

We have tried our level best to follow election code of conduct in this issue. I hope this issue will be successful in providing various aspects of Open Source Software.

Finally, we look forward to receive the feedback, contribution, criticism, suggestions from our esteemed members and readers at csic@csi-india.org.

Wishing you all a Happy and Prosperous New Year 2016!

Chief Editor
Greetings!

You will be happy to note that CSI-2015, a Golden Jubilee Convention of CSI concluded successfully on 5th December, 2015 at Delhi. The organizing team from CSI ExecCom Prof. M. N. Hoda, Mr. R. K. Vyas, Mr. Shiv Kumar and Dr. A. K. Saini with members of Delhi Chapter and NCR chapters worked untiringly for organizing this mega event. They need appreciation from all of us. Participants and delegates witnessed the gala inauguration of Convention, Awards ceremony and quality deliberations by distinguished speakers, IT leaders and academicians. Various statutory meetings of ExecCom, National Council, General Body, Chapter OBs with Auditor, Regional, Division and SIG conveners were held successfully during the convention. CSI-Nihilant e-Governance Awards function witnessed presence of many representatives from various states. It was joyous moments for technical paper presenters during the conference. I thank the management of Bhartiya Vidyapeeth for providing venue, faculty and student volunteers.

In the inauguration function Chief Guest Shri R. S. Sharma, IAS, Chairman, TRAI talked about Digital Empowerment and various initiatives of Government of India. Guest of Honour and Hon. Fellow awardee Shri J. S. Deepak, IAS, Secretary, DoT, Ministry of Communications & IT, Government of India deliberated about initiatives of Government like Digital Services in all possible Indian languages, Government websites in vernacular languages and Digital literacy. Prof. S. V. Raghavan delivered his keynote address and Dr. K. K. Aggarwal, Chair, Programme Committee, CSI 2015 talked about CSI 2015. The invitees and members witnessed the Awards ceremony in which prestigious awards of CSI : Honorary Fellow, Life Time Achievement Awards, Fellow Awards were given to distinguished members.

I visited CSI, Trivandrum Chapter on 9th December, 2015. Shri Sreekanth P. Krishnan, Chairman and Managing Committee members discussed various initiatives of chapter for promoting CSI. I appreciate their efforts for organizing various events for professionals and members including partnering with Kerala State Government for Knowledge Sharing Summit 2015, hosted by Kerala State in December, 2015. MC members gave few suggestions about improving the visibility of CSI in Government, IT companies and academic institutes.

I delivered a keynote address on ‘Digital India’ on 10th December, 2015 in the “Knowledge Sharing Summit 2015” hosted by Kerala State jointly with Computer Society of India at Thiruvananthapuram. The event was well attended by the Government officials and members of CSI SIG for eGovernance.

A report of this event is published in this issue.

I had also an opportunity to visit the CSI Student Branch of NMAM Institute of Technology, Nitte, Udupi District, Karnataka on 18th December 2015 during my NAAC visit. Dr. Niranjan Chiplunkar, Principal and Prof. Sharada Shenoy, CSI Student Branch Counselor are active in organizing technical events for the benefit of the student members.

During recent visit to India, Mr. Sundar Pichai, CEO of Google mentioned that two million Android Developers to be trained in three years. There will be big push to voice and text search in Indian languages. He reported Hindi content search traffic grew 84% in the latest quarter against 13% growth in English language search. He also announced about new campus of Google in Hyderabad and new hirings in Bangalore and Hyderabad. This brings many opportunities for Indian IT talent.

I wish you and your family a Very Happy New Year.

With best wishes,

Bipin V. Mehta

Prof. Bipin Mehta, Director, School of Computer Studies, Ahmedabad University, Ahmedabad, president@csi-india.org
1. First I would like to wish all our members a very Happy and Prosperous New Year! Let us work towards strengthening our society and adding more members. Organizing interesting programs will attract IT professionals to CSI.

2. CSI Elections have started and are going on. User names and Passwords have been sent to all the eligible voting members. Members are requested to exercise their voting rights.

3. I am glad that Publication Committee led by Prof. A. K. Nayak has announced publication of CSI Adhyayan and the first issue in e-format (Sept – Dec 2015) has been uploaded on the web site. Congratulations to Prof. Nayak, Dr. Vipin Tyagi and Dr. Nilesh Modi for the excellent work! This publication will help in attracting the student community to CSI.

4. Our attempts to strengthen all the Special Interest Groups (SIGs), have not been too successful. Except very few SIGs, most of these are dormant and with membership restricted to a particular team.

SIGs have been aligned with different Divisions and all their activities must be reported to the corresponding Division Chair.

5. Inspite of repeated appeals, event organizers are not using the correct registered logo of CSI which is reproduced below.

6. There have been complaints about misuse of CSI logo and organizers at different levels are using CSI logo without approval of the CSI management. Misusing of CSI logo and associating with all sorts of conferences is affecting our image.

Engineering colleges that do not have CSI Student Branches are using CSI logo as a Sponsor without mentioning the name of the Division or the Chapter who have approved the sponsorship. Needless to say, our endeavor to open more Student Branches is affected due to this and is undesirable.

All Division Chairs and RVPs are therefore requested to prevent misuse of CSI logo and ascertain from the organizers the genuineness of the sponsorship. If a CSI Chapter or a Division is sponsoring, then their name should be clearly stated below CSI logo.

7. I have also proposed that all Chapters/Student Branches/Divisions conducting any event or supporting any event must keep the RVP of that region informed.

This will help in better coordination and reporting by RVPs in ExecCom meeting. RVPs on their part will check the authenticity of sponsorship so that misuse of CSI logo is stopped.

8. We are trying to expand our international membership and enlist IT professionals working abroad. We need to take CSI to international standards both in publications and in the events that we organize. For this we have requested Prof. Dharm Singh, an active CSI Member who has held important positions in CSI and presently working abroad to serve as a International Coordinator to facilitate this.

Let us all work together and move forward in the New Year in taking CSI to greater heights.

Best wishes,

Dr. Anirban Basu

Vice President, CSI

Prof. Dr. Anirban Basu, Vice President, vicepresident@csi-india.org
CSI-2015
Golden Jubilee Annual Convention
A Brief Report by Prof. M. N. Hoda
Chairman, Division – I and Secretary, PC, CSI-2015

Computer Society of India (CSI) hosted CSI-2015, its Golden Jubilee Annual Convention from 2nd - 5th December, 2015 at New Delhi. The theme of the Golden Jubilee Annual Convention was “Digital Life”.

The convention commenced on 2nd Dec., 2015 with the Inaugural function at FICCI Auditorium, New Delhi. Shri R.S. Sharma, IAS, Chairman, TRAI, Govt. of India was the Chief Guest, Shri J. S. Deepak, IAS, Secretary, DeitY, MC&IT, Govt. of India was the Guest of Honor. Prof. S. V. Raghavan, Former Scientific Secretary, Office of the PSA, Govt. of India addressed the gathering with his keynote address. The inaugural function was presided over by Prof. Bipin V. Mehta, President, Computer Society of India. The function was conducted under the august presence of Prof. K. K. Aggarwal, Former Founder Vice Chancellor, GGSIP University, New Delhi and Prof. Anirban Basu, Vice President & Chair, Conference Committee, Computer Society of India along with many other distinguished luminaries and guests, under the blessings and kind patronage of the Father of Indian IT Industry, Padmashree Dr. F. C. Kohli, Founder, TCS.

Shri J. S. Deepak, IAS, Secretary, DeitY, MC&IT, Govt. of India was conferred the Honorary Fellowship on the occasion. Further, Life Time Achievement and Fellowship Awards were conferred to many stalwarts who have contributed significantly in the development of CSI, in particular and the society, in general. The inaugural saw the confluence of over 550 distinguished minds at a common platform.

The Technical sessions of the Annual Convention were initiated on 3rd December, 2015 at Bharati Vidyapeeth’s Institute of Computer Applications and Management (BVICAM), New Delhi, with 13 Parallel Tracks having 06 Technical Sessions in each of the track. Authors presented their technical papers in these parallel sessions. Every session was chaired by a panel of distinguished experts chosen from organizations of repute. From over 1500 papers received for the convention, 566 papers were accepted, which were presented during the three days technical sessions of annual convention. The convention provided a forum to bring together software developers, engineers, researchers and practitioners from Government, Judiciary, Academia and Industry.

During the convention different plenary talks were held by distinguished experts. Noted Cyber Law Counsel, Supreme Court of India, Advocate Pawan Duggal delivered a talk on “Cyber Law”. Talk on “Next Generation Networks” was delivered by Mr. Rajesh Kumar S., Tech Lead, Juniper Networks. Ms. Swati Mehrishi, Springer India, New Delhi discussed “The Art of Writing Quality Papers” with the audience. Mr. Sachin Waingankar, Head (Solutions), Converged Data Technologies Private Networks gave an introduction to “Exploring the Potential of Cloud Services”. Mr. Sudhakar, CMD, ECIL, Hyderabad delivered innovative talk on Next Generation Networks and many more.

The three days convention also noted two panel discussions on Digital India by distinguished panel of experts including Mr. Ibrahim Ahmad, Group Editor, Cyber Media, Gurgaon; Justice Talwant Singh, District and Sessions Judge, Govt. of NCT of Delhi, Ms. Shakti Raina, Head, Technology, Telecom Sector Skill Council; Mr. P. C. Mishra, GM (Systems), Coal India; Mr. Rajiv Garg, ED (IT), BHEL; Mr. Amajit Gupta, Managing Director, Juniper Networks; Mr. Sachin Waingankar, Head (Solutions), Converged Data Technologies Private Networks; Mr. K.S. Venu, Tally Solutions and chaired by Prof. Ravi Mittal, Vice Chancellor, KR Mangalam University, Gurgaon.

The second panel discussion was conducted by experts including Lt. Gen. (Rtd.) Ashok Agarwal, Head, India Operations, AVG Technologies, USA; Mr. Prakash Kumar, IAS, CEO, GSTN, New Delhi; Mr. S. N. Gupta, Secretary General, NGN Forum, India; Dr. Kamaljit Singh, ED, IMS Noida; Mr. Raju Kanchhibhotla, CSI and chaired by Prof. P. B. Sharma, Vice Chancellor, Amity University, Gurgaon.
The convention also noticed a cultural evening to mark the CSI-2015; Golden Jubilee Celebrations. Shri Saurabh Bhardwaj, Former Minister, Transport and Urban Development, Member of Legislative Assembly, Govt. of NCT, Delhi was the Chief Guest. The highlight of cultural evening was Kavi Sammelan by noted poets presided over by Prof. Irtaza Karim, Director, NCPUL, MHRD, Govt. of India.

The occasion also provided a platform for release of two Computer Science books; one by Prof. Anirban Basu on “Software Testing and Reliability” and another by Dr. Mansaf Alam on “Digital Ogic and Computer Design” published by PHI by Prof. K.K. Aggarwal, Former Founder Vice Chancellor, GGSIP University, New Delhi, Prof. P.B. Sharma, Ex-Vice Chancellor, Delhi Technological University and Vice Chancellor, Amity University and Prof. Bipin V. Mehta, President, Computer Society of India.

The three day annual convention on its last day was culminated by 50th Annual General Body Meeting of the Computer Society of India. The convention was concluded on 5th December, 2015 with the Valedictory Session, where Prof. Anirban K Basu, Vice President & Chairman, Convention Committee thanked all the persons involved for successful conduct of the event. He also thanked the Management, Faculty, Staff and Students of Bharati Vidyapeeth’s Institute of Computer Applications and Management (BVICAM), New Delhi, for their organization and other technical support for making the convention, a reality and also to all the technical supporters, sponsors, etc. The proceedings of the papers presented during the convention shall be published by Springer in ten topical volumes under AISC series.

The convention was well received and attended by over 2000 participants/delegates/participants from all walks of life.

CSI Nihilent eGovernance Awards 2015

The Special Interest Group on e-Governance of Computer Society of India (CSI SiGeGOV) had organized the 13th CSI Nihilent eGovernance Awards (CNEA 2015) on 3rd Dec. 15 at the Bharti Vidyapeeth Auditorium, New Delhi. The event took place coinciding with the 50th Golden Jubilee annual convention of the Computer Society of India where 45 of the 222 successful nominees received their awards from the Guest of honor Prof. Bipin V. Mehta, President CSI and other dignitaries on the dais.

Shri Surendra Kapoor, Chairman SIG eGOV welcomed the invitees, guests, award winners and delegates and conveyed deep appreciation of the efforts of the selection committee members for their diligent short listing, nominees for their enthusiastic participation and the sponsors Nihilent Technologies for their passionate support and patronage.

Speaking at the awards ceremony on behalf of the Convener team Shri Prabhu Gollamudi, said, “This year the response from Government officials from across both Central and State Governments departments/institutions is very encouraging and reflects on the importance of the CSI Nihilent e-Governance award by the practitioners/implementers of e-Governance projects cutting across functional/technology domains. He attributed this patronage to the key differentiator - projects assessment process i.e., a multi-stage and multi-dimensional assessment including field visits. He further opined that the sustained efforts of CSI SIG over the last many years in promoting e-Governance awareness and knowledge through the awards and knowledge sharing sessions compliment the overall efforts of policy makers towards India transforming to become a “Digital India”.

It has been our honour and privilege to be associated with the awards and we will continue to do so stated Shubhhabrata Banerjee, Chief Financial Officer at Nihilent speaking on behalf of the sponsors.

Dr. Piyush Gupta, Associate Vice President, NISG speaking on the occasion reiterated the importance of planning and conveyed that projects have to be designed for success including sustaining the initiative by adequate capacity building.

Dr. Ashok Agarwal, Founding Member, CSI-SiGeGov spoke about the long and successful journey of recognizing best initiatives of e-Governance projects and hoped continued efforts of SIG team will improve the assessment process further.

Prof. Bipin V. Mehta, President-CSI, Guest of honor conveyed his happiness of good work by SIG e-Governance team and the sponsors and hoped that the entire process will stand as a reference benchmark for evaluating e-Governance projects in the country and also hoped projects from many more sectors also participate.

This year the State of Haryana has won the Award of Excellence under State category and the Union Territory of Chandigarh won the Award of Sustained Excellence under the State category. Four of the 2010 CSI Nihilent e-Gov award winning projects were also recognized for sustained project excellence. In all there are 11 projects which received Award of Excellence including 2 from GOI departments, 22 projects Award of Appreciation and 6 projects received Award of recognition. The list also included one project from North East region and one project from J&K.

The awards ceremony was well attended with Sr. officials from award winning nominees actively participating and expressing their joy representing the winning teams. Kudos for the excellent support of CSI-2015 organizers and Nihilent Technologies for continued commitment.
MongoDB - An Open Source NoSQL DB
R. Sasikala
Associate Professor, Computer Networks Division, School of Computing Science and Engineering, VIT University, Vellore

The voluminous amount of digital data created in your surroundings by Industries, social media, scientific applications and Govt. agencies is called Big Data. IDC (International Data Corporation) research states that 90% of the data is unstructured and not in table format[1]. The traditional technologies are not adequate for processing complex and large data. Hence, the technologies like MapReduce, Cloud Computing, Bigdata analytics, Visualization and NoSQL(non SQL) are evolving to process bigdata. Among these, NoSQL databases are developed to support and integrate cloud, bigdata and data analytics applications. The giants who run social websites such as Google, Facebook, Twitter and Linkedin started showing interest on developing NoSQL technologies. It is considered to be an alternative to relational databases (SQL databases) but not the replacement for all the applications. The following are the differences between SQL databases and NoSQL databases:

SQL Database
- Best suited for Relational Database applications
- Supports structured schema and databases are represented basically as tables
- SQL supports complex queries like join
- SQL databases are vertically scalable
- SQL databases follows on ACID properties (Atomicity, Consistency, Isolation and Durability)
- SQL Databases are Oracle, MySql, Postgres, MS-SQL etc.,

NoSQL Database
- It does not use structured Query language(SQL) for processing
- It supports Dynamic (not fixed) Schema
- It does not require join query to perform operation on multiple table
- It follows distributed and fault tolerant architecture
- NoSQL emphasizes on CAP theorem (Consistency, Availability and Partition tolerance)
- NoSQL free and open source databases are MongoDB, BigTable, Hbase, CouchDB etc.,

Wide variety of technologies are developed to solve the issues in relational databases and for the demand of bigdata technologies. Selecting right kind of NoSQL database for your research or application development is important. Out of existing technologies, MongoDB is simple to use, learn, install and apply for research issues. Plenty of learning materials, usecases and links are available to use MongoDB for student projects and for research purpose. In addition, the MongoDB is free and open source. The objective of this paper is to discuss features, installation steps, basic working style, research areas using MongoDB and the online MongoDB university courses. The paper assists as a basic guidance to the students and researchers who are interested to learn and use MongoDB for their project and research.

MongoDB Introduction
MongoDB is a dominant and widely popular document oriented database paradigm for non relational database applications. The key features of MongoDB are:
- It is an open source document oriented NoSQL Database
- The MongoDB Indexes support faster query rate
- MongoDB’s replication and auto sharding (horizontal partitioning) features provide high availability and automatic failover
- Automatic Sharding distributes data across multiple machines. It provides horizontal scalability
- MongoDB's current release: version 3.2 introduced encrypted (built-in) storage engine which helps to secure the sensitive data without additional overhead
- MongoDB 3.2 uses WiredTiger as a new storage engine which reduces storage overhead by 80% and increases performance by 7-10x.
- MongoDB 3.2 has the capability of in-Memory computing
- MongoDB 3.2 not only supports key-value operations, it supports complex queries, secondary indexes and aggregations

JSON and Document Oriented Database
MongoDB records are documents and each record in the form of key value pair as shown below:

```json
{  
  "name": "Arun",  
  "age": 28,  
  "groups": ["Admin", "Academic"]
}
```

The documents (records) are similar to JSON (JavaScript Object Notation) objects. The value field in key-value pair includes text, numbers, arrays and other documents. JSON is human readable format and it supports schema less database well. Also document based technologies reduce join operation and make the queries simple. Hence, the MongoDB facilitates users the flexibility of JSON documents to construct the documents in lightweight format.

Installation Steps
The MongoDB shell is an interactive JavaScript shell. The other languages supported by MongoDB are C, C++, C# and .Net, Java, Node.js, Perl, PHP, Python, Ruby, Scala. The corresponding drivers are available for download in https://mongodb.org. MongoDB supports 64 bit architecture and runs on most of the platforms such as Windows, Red hat Linux, Amazon Linux, OS X, Ubuntu, Fedora and Debian. This paper explains installation steps for Windows OS only and for other OS, refer the website[2].

Step 1: Download MongoDB for Windows

We can download MongoDB installer package .msi file (for Windows) freely in link: https://www.mongodb.org/downloads and the current stable release is 3.2.0.

Step 2: Run by double click the .msi file and the instructions will guide you to install.

Step 3: Check the drive of MongoDB folder created by run command

```
Step 4: Go to MongoDB folder and check
```

if MongoDB’s bin folder is in c:\MongoDB\Server\3.2\bin,

Create C:\data\db folder by executing dos command at prompt

```md data\db to store data files```

Step 5: Start MongoDB database
process by clicking mongod.exe file in c:\mongodb\Server\3.2\bin\mongod.exe or run mongod.exe file in command prompt. mongod.exe will run as a background process.

Step 6: Start MongoDB shell by double clicking mongo.exe file in bin folder or open new command prompt and run mongo.exe file. This shell will run as interactive shell and execute commands.

Step 7: When necessary, close the MongoDB by using exit command at MongoDB shell.

These simple installation steps give a hand to readers to install MongoDB in Windows 7. The above shell shown in Fig 1 is a component of MongoDB package. The shell facilitates the users to learn and work with NoSQL queries and for administrative operations. The NoSQL queries can also run as a script.

MongoDB Shell Scripting

We can write script using default scripting language JavaScript and save the file as filename.js. This JavaScript code can be run to mongod shell. Consider the following example to show how to run JavaScript code in MongoDB:

To start with, Create a collection (table) school in mongo shell.
Next, type the following script in notepad and save the file in bin folder as example.js.

• Run mongod.exe.

Sample Script-example.js

```javascript
cursor = db.school.find();
while (cursor.hasNext()) {
    printjson( cursor.next() );
}
```

To learn MongoDB, start with CRUD (Create, Read, Update and Delete) commands in Shell and go performance, replication, sharding, security, backup and restoring commands. It is good to take one free online course in MongoDB university for basic understanding.

Potential Research Areas with MongoDB

The articles in MongoDB website, journals papers and white papers are available for students and research scholars in MongoDB[3]. To contribute projects in MongoDB, refer link : https://github.com/mongodb/mongo. Following are the sample research areas that can effortlessly make use of MongoDB database tool for implementation.

• Aggregation
• Map-Reduce
• Solving Difficult Analytical Problems
• Multiple Data centre Deployments
• Security in Deployments
• Auto Sharding
• Internet of Things and Bigdata

MongoDB University

MongoDB university offers free online courses run by 10gen to learn how to build and deploy applications on MongoDB. The course consists of lecture sessions, quizzes, weekly assignments and tests. Students who score above 65% can get certificates.

Conclusion

The article gives exposure of MongoDB. Moreover, MongoDB is easy to lean and can be installed in local systems. Bigdata projects and MongoDB certification creates the opportunities in Bigdata field.

References

[2] https://docs.mongodb.org
[4] https://github.com/BioinformaticsCore/MetagenomeDB

About the Author

Dr. R. Sasikala [CSI - 11502421] is currently working as Associate Professor, Computer Networks Division in School of Computing Science and Engineering at VIT University, Vellore, Tamilnadu, India. Her research interests include Cloud Computing, Big Data, Wireless Networks, Body Sensor Networks and Optical Switching Networks. She can be reached at sasikala.ra@vit.ac.in.
Open Source Software Versus Commercial Software

Noopur Goel
Asst. Prof., Department of Computer Applications
VBS Purvanchal University, Jaunpur, U.P. India.

With the growing popularity of open source, the software industry's scenario is totally changed in recent years. Two major models of software licensing – Open source and commercial software are the most discussed topics in the technical community. Most of the countries across the world, especially the developing countries are facing some challenges namely-

i. tackling with the piracy problem,
ii. aspiring to have greater control over the software and
iii. dealing with a policy aspects on how to develop a successful domestic software industry.

Open source, to some extent, promises to offer solution of these challenges. Open Source Software (OSS) is becoming an important resource for development, especially in developing countries.

Definitions of the two licensing models:

“Open Source” is a software-licensing model where the source code of the software is typically made available royalty-free to the users of the software, under terms allowing redistribution, modification and addition, though often with certain restrictions. The support, training, updates and other services for the software may be provided by a range of entities, increasingly under commercial arrangements. Open source programs are often, though not exclusively, developed through a collaborative effort in which a number of persons contribute elements of the final software. Software companies are also contributing paid programmer time and programs developed in-house to the open source community(1).

OSS refers to software released under a license that allows the end use to freely use, distribute and modify the source code of the program. OSS is frequently known as “free” software, which means the freedom and not the price of the software. Popular OSS projects include Linux, Eclipse, Apache, Tomcat and the Mozilla suite of the programs.

“Commercial Software” refers to the software developed by a commercial entity and is typically licensed for a fee to a customer (either directly or through channels) in object, binary or executable code. The commercial entity often provides support, training, updates and other similar services needed by customers to efficiently use that software. The source code of the software may be made available to certain users of the software through special licensing or other agreements, but is usually not distributed to the general public, and may not be copied or modified except in a manner provided for in such agreements(1).

Selection and procurement policies of the software should be derived from the value-for-money and fit-for-purpose concerns. It should not be chosen depending on the broad categorization of the two licensing models. Customers’ needs in a specific condition derive the benefits and suitability of the considerations relating to open source and commercial software models. In the following sections, technical and policy issues are discussed related to open source and commercial software models.

Technical Issues:
To compare the strengths of different software models- one must consider the specific need and circumstances of the customer’s environment where the software is to be deployed. Three major technical issues which should be considered are cost, security and flexibility.

Cost: Few people advocate that open source software is cheaper than commercial software yet the commercial model’s supporters point out that for the same functionality the total cost of ownership for commercial software can be less than for open source software.

The decision of buying OSS or commercial software should be taken in terms of lifetime costs and migration costs of a product. In the entire lifecycle of the software, the recurrent subscription cost, long term support cost, maintenance cost and other tangible costs such as usability of the product and productivity gains must also be taken into account.

The cost of retraining of users, who are already familiar with the one product, is also significant which includes:

i. the total time spent by the users while undergoing such retraining and
ii. resulting initial lower productivity level during the period when users become competent with the alternative product.

Security: Security of software is an industry-wide concern and vulnerabilities are always present in the software, which affects the complex software programs. The main issue is how to reduce and remedy these vulnerabilities instead of seeking for which licensing model is more secure software. Different opinions exist regarding the security of the two licensing models: some argue that since there is access to source code in OSS so lesser security exists here, some argue that since source code of OSS is available for public scrutiny so, this model is more secure. Some people have viewpoint that access to source code has nothing to do with security of the software. The three main factors which affect the security of software are:

i. the value-for-money and fit-for-purpose concerns.
ii. resulting initial lower productivity level during the period when users become competent with the alternative product.

Flexibility: The availability of source code of the OSS leads to the argument that they are more flexible as the technically sound customers may identify any problems in the system and may make
changes or fix it to solve the problem whereas in case of commercial software the updates are available only from the original software vendors. The commercial vendors have their credibility on stake as get an incentive to ensure reliability of the updates and patches. Although, these updates and patches may come from many sources or may be quickly available as they may be developed through community efforts and distributed through channels such as discussion groups. As these solutions are not having rigorous testing, they may need to be iteratively improved if they do not correct the problem initially.

The community contributors have less accountability as compared to commercial software providers.

For any efficient business operations two factors are very important: certainty and predictability. So, the main issue regarding the flexibility is to consider whether there is a need to customize the acquired software (at application or operating system level) to meet specific needs. If customization is required, the users need to acquire additional resources to support such non-standardized customization in the original release of the software. If customization is not done to the original software but is built in addition to a layer above the software, then there is no relevance of what the software license model of the acquired software is.

**Policy Issues**

The developing countries have shown interest in OSS as a possible solution to the issues such as to cope with the piracy problems, digital divide issues, and to develop domestic software industries in order to overcome the dependence on the software sources. However, mere adoption of OSS is not the solution to address these issues.

**Piracy:** High cost of the software is the most important factor which leads to software piracy. In the developing countries, consumers seek for low cost pirated software to fulfill their computing needs. It is assumed that the adoption of OSS, which may be legally copied and circulated legally in a royalty free way, is the promising solution to reduce the software piracy.

However, it is also observed that in developed countries the practice of software piracy is done although at lower rate. So, the high cost of the software is not the main issue. Government should try to change the attitude of people and educate them towards piracy, and promote to recognize the value of intellectual property and need to protect it, which is a vital asset important for the country’s information economy. Higher piracy rate hinders the development of in-house software industry, so government should try to create a favorable environment to lower the piracy rate.

**Digital divide:** In order to bring the “digital equality” initiatives are taken, especially in developing countries, to manufacture low cost personal computers and make it available for the general public. In order to reduce the initial cost of personal computers, these are often installed with OSS. However, as in the previous subsection it is already discussed that OSS is not always cheaper than the commercial software when total cost of ownership is considered. Gradually, companies are taking initiative to offer their support to reduce digital divide by providing low cost commercial software also.

Governments of developing countries, where digital divide is prominent, should make an effective plan to address the issue of digital divide which covers every dimension of preparing the general public for the information age. With this motive, mere the provision of computer technology is not enough; the agenda should also consist of an inclusive plan:

i. which will provide the necessary information technology and software literacy skills to the lower income families so as to empower and enable them to make use of the technology.

ii. to address the infrastructural needs such as to ensure that there is sufficient and appropriate content and applications which are relevant to the general public (e.g. e-government services), and to have trustworthy connectivity available for the public to access these content and applications.

iii. to generate the need for access of these content and applications, which is far more critical to achieve than to provide access to technology.

**Domestic Software Industry Development:** For a country to develop, Information Technology and Software Industry are observed as a significant segment from years. Governments of developing countries are making strategies to give preference to procure locally developed software in comparison to foreign products as a solution to maintain the level of success of foreign developers and local developers. In this line, some governments give preference to OSS to start their domestic software industry by using the available source code to further develop and build their own software solutions.

While considering building their domestic software industry, governments and business enterprises speculating into this sector must do the followings:

i. Scrutinize which software development model (e.g. off-the-shelf, customizable products, custom-built products and embedded software products) to promote to get the desired outcome.

ii. Have good understanding of the mechanics of different software licensing models especially various OSS model is based upon e.g. the General Public License (GPL).

iii. Ultimately, government must realize that they can achieve the objective of domestic software development industry by their initial funding to OSS development companies only if these companies could make themselves commercially sustainable without continuous government funding of OSS projects.

**References**


---

**About the Author**

Dr. Noopur Goel [CSI - 11501432] is serving as Assistant Professor with the Department of Computer Applications, V.B.S. Purvanchal University, Jaunpur, India. She has her MCA Degree from National Institute of Technology, Jamshedpur, India and Ph.D. in Computer Applications from Banaras Hindu University, Varanasi, India. She has been engaged in teaching for the last 15 years and the areas of her research interest include Software engineering, Software Reuse, and Software Testing. She can be reached at noopurt11@gmail.com.
Open Source Software has gained tremendous popularity in last few years and is progressing at a continuous speed beyond the world of IT. In today's world it has appeared as an area of business-and therefore a competitor also. Because of open source’s characteristics of ‘free-of-cost’ principle, it has great impact on almost every area, nationally as well as internationally.

This article focuses on the prospects of applying open source software in education, business, and developing countries and in government. We will also consider the Indian government scenario in this aspect that is recently regulated in policy on adoption of Open Source Software for GOI (Government Of India) in April, 2015. Academia has adopted open source software in different learning activities for the reasons that it resolves various persistence technical challenges. Despite all the technical challenges, OSS offers an approach to solve technical problems by providing guaranteed and optimal delivery of online learning. Digitization of education is a new occurrence that has changed the education sector through online courses, virtual educational portals, virtual universities and online courses. Open source provides various advantages and has great impact on learning that included flexibility, tax benefits, continuous improvement etc.

One more aspect of impression of OSS in education is escalation of learning management system(LMS). LMS tools are used to develop and manage learning contents on web. Some of the famous tools are Moodle, Bodington, Claroline, .LRN, ATutor, OLAT, and Sakai[1]. Open source and Digitization of education has gained considerable maturity and together both have great potential to change the face of education.

Almost all IT companies have some or more interaction with OSS today. IT is all about the continuous flow of information and in this way fundamentally related to the economic growth of any developing country. And thus OSS cannot be viewed merely as a product but it governs the economy. Open source projects are increased in abundance from 500,000 in 2007 to 1,500,000 in 2015[2]. Open source grows at a rate of 30% and more. By 2016, at least 95% of IT companies will take the advantage of open-source technology in their censorious cases- an increase from 75% in 2010 [Source: Black Duck Audit Results].

As a result of technological development in every sector including public services, there is a great need for government services systems to be put together for quick accessibility of information. Thus in this way, government is also taking initiative. In this section, we present you the Indian initiative of making digital India. To meet this objective, GOI has been promoting the use of open source technologies and has been encouraging their adoption in eGovernance applications. To enable the adoption of OSS, Department of Electronics and Information Technology (DeitY) has formulated a “Policy on Adoption of Open Source Software for Government of India” in April-2015. In addition to this policy the DeitY has also formulated a “framework for adoption of OSS in eGovernance applications”[3].

References
Under the digital India initiative ICT enabled services have to be made available to almost all the citizens of the country. Under this initiative, public services from Govt. organizations including centre to block and village level agencies must have sufficient and robust ICT infrastructure to support and deliver real time citizens demand towards ICT assisted services under various public domain such as police administration, health services, farmers and agro based services, services for the people below poverty line, educational services to quote a few.

With the above quoted scenario in this paper, I have tried to focus one dimension of ICT infrastructure availability for the Govt. agencies that is procurement of required software, databases with minimum financial expense and maintaining the sharing, uniformity as well as compatibility, inter-operability of such entities functioning at different locations and different levels.

The proposed solution for automation of Govt. agencies, is to build a SaaS cloud in any Govt. agency at a top level using open source platform and open source software tools for the deployment of various applications to cater the need of public services with quality and security. And the same will be shared by all the agencies into downward hierarchy. Such as if it is developed at centre level agency then it may be shared with state level, district level and block level, this will eliminate scope of creation of separate resources at every level of service delivery point.

This cloud will include software agent based an intelligent web interface which will interactively analyze software requirements of an agencies then online deploy and configure all required applications to the client site collecting from the SaaS cloud. So to make all these possible let us have a view of these core components. (Cloud, Software agent & Open source software).

Cloud Computing: During 1980 to 1990 in the world of computing ASP (Application Service Providers) emerged with rapid growth in client based computational solution providers in the most part of the world and gradually it has created a base for the present form of Cloud System.

In this article, I have tried to model a Public SaaS cloud by integrating Open source technology, Software Agent and Cloud Computing.

There are a number of buzz words about cloud computing, such as:

“Computing as a service over the Internet. Cloud computing, often referred to as simply “the cloud,” is the delivery of on-demand computing resources—everything from applications to data centers—over the Internet on a pay-for-use basis.” (www.IBM.com)

“Cloud Computing is a general term used to describe a new class of network based computing that takes place over the Internet, Cloud computing is an umbrella term used to refer to Internet based development and services”. (www.cse.unr.edu/Mark Baker)

“Cloud Computing Refer to a variety of services available over the Internet that deliver compute functionality on the service provider’s infrastructure” (www.research.MicroSoft.com)

Conclusively cloud computing is a system for providing on demand computing resources to related user. Basic features of cloud is its availability, flexibility and abstraction of complexity of the technology to its users. Cloud is system for re-configurable computing resources over internet. It provide its resources accessible to its concerned users without giving load of maintenance and up gradation as all such responsibilities lies with Cloud provider. So like ISP(Internet Service Providers) there are a number of CSP(Cloud Service Providers) who are delivering cloud services under different forms such as;

SaaS: Software as a Service, IaaS: Infrastructure as a Service and PaaS: Platform as a Service.

SaaS (Software as a Service): Our concern is SaaS (Software as a Service), under this form of cloud services all kinds of applications and software tools required by users are developed and deployed via internet by the cloud provider for the user. On the other hand, user owns all the control over the application and use it for the required period and operations. In case, any damage occurs to the application as well as data during uses, the whole

![Cloud Computing Diagram](Fig.1: Courtesy www.en.wikipedia.org)
things are re-deployed by the provider within minimum span of time. Under this model of cloud any user can get any sort of innovative business application and use it for dynamically changing requirement load and make payment for actual usage with usage elastics.

**Open-source software (OSS):** It begins long back with a paper presented by Eric Raymond in 1997 which has been taken as a base for the origin for Open Source Initiative and Open Source Software in 1998. Before it there was a Free Software Movement in 1983.

Conceptually, OSS is a process of democratizing copyrights of software and the software with all its components from its core developer to a number of contributing developers and users. OSS dictates that any software made available to public with its source code by its author/developer having copyright of it.

With a permission for its use, update and redistribution by any one for any number of people. This is also referred as open source or free licensing. With these facts a lot of software including OS like Linux, Applications like Knopix office, web browser like Mozilla Fire fox, front tools (Elements, Kube), backend tools (JSP, PHP), web servers (Nginx, Apache) database (Mysql) are available for public use almost free of cost. These software have full potential for the design and deployment of web based software solutions and ERP systems.

**Software Agent:** It is basically an intelligent software which is capable to interact with its environment and remain functional continuously without any direct control. SA may be considered as persistent, goal-orient, autonomous computer program which observes processes running in its environment using provided set of sensors and acts/intercepts to its environment using provided set of actuators and direct the activity towards achieving the goal.

Sometimes SA may be considered as a software robot. There are a number of model of SA based on various statistical and mathematical principles. SA includes an evolutionary step beyond conventional computer programs with a pre loaded domain knowledgebase. SA can get active and start executing themselves, without having any external input a little bit like a trigger in a Database. SA is able to initiate, monitor, and terminate other programs or agents which may be an applications or it may be an online intelligent agents.

For a general concept, SA may be similar to a Simplex reflexive system such as a thermostat of any cooling or heating equipments. In the case of our proposed SaaS cloud we will consider model based reflex agent for the design and deployment of web interface and Specification& optimization module of Open Source SaaS cloud.

**Conclusion**

After the coverage to core components our proposed Open Source SaaS cloud will be having resource servers, storage servers, Model based reflex Agent integrated requirement specification and optimization module, Cloud cart & delivery module, SA based intelligent web interface. The whole system flow will take place as:

1. User (Govt. agencies at any level) will send requirement through the web interface
2. SA based Optimization & specification module with validate requirement and assist the user to confirm requirement
3. SA based Optimization & Specification module will collect required resources from cloud server and put it on cloud cart
4. Cloud cart will deliver and configure required resources SA based web interface
5. SA based Optimization & Specification module keeps continuous monitoring and backup of resources delivered to the user site as well as transactions & data being generated at user site through the intelligent web interface.

6. In case of any damage or failure, SA based Optimization & Specification module will automatically recover the system at user site with minimum down time.

Finally, this model will help Govt. agencies to develop innovative software and share with uniformity with minimum financial burden. Also this will help to implement common solution for national domain. Maintenance and security of entities deployed under this model will be easy.

**References**

[5] A Primer on Open Source Software for Business People and Lawyers by Stephen J. Davidson
[8] www.electromagnetics.unisalento.it

---

**About the Author**

Lab of Things (LoT)

A. Jameer Basha
Prof. & Head, Department of Information Technology,
Sri Krishna College of Technology, Kovaipudur, Coimbatore

Nowadays the usage of number of devices and sensors has increased in places where people live and work. Some of the frequently used devices in use at home includes light, water heaters, security cameras, doors, windows, power meters and thermostats and more. Sensors can be deployed on these devices for detecting temperature, humidity, motion and distance. For security purposes some of the houses use surveillance camera and monitoring. With the eternity of sensors and devices, there is a developing need to effectively interconnect and manage them. From these devices and sensors there is a need to monitor the status and data collected. Deploying devices and sensors for field studies are growing exponentially with increase in several devices and geographic dispersion. For example, if a researcher works in three different domains: Work starts with some initial field works and later analysis on the data from that experimental works. Field work can be at a diverse set of locations, and hence it becomes difficult to deploy and monitor the field work. To overcome this difficulty, LoT is being used in real world applications.

Lab of Things (LoT) provides deployment and monitoring of the field studies by interconnected devices across geographic dispersion and allows collection of data easier for storage in the cloud. LoT works as a flexible platform for experimental research and smart home.

Working: Lab of things offers software framework connecting several devices in a home and beyond home. The devices include IP cameras, Z-Wave sensors, door sensor, custom devices built using .NET Gadgeteer, and more. LOT brings down the barriers of doing research with connected devices. It consists of two client core components: HomeOS and Windows Azure. In each home, HomeOS is installed on a Windows PC. This one is called as HomeHub. Lab of things uses HomeOS for implementing application scenarios. The HomeOS hub accomplishes the devices and sensors interconnection through device drivers, and permits LoT applications to access functionality of devices through a set of APIs.

Home Hub & HomeOS: All the devices and sensors used in the home are connected through network technologies like WiFi, Z-Wave, etc. Windows Azure offers cloud services. The developed apps are installed in HomeHub. Homehub is an implementation device and app collects the data or stimulate devices. In this method, many number of HomeHub can be developed and all the HomeHub can be connected to the cloud services. Additionally, framework allows to monitor the system status, updating installed applications, storage of data and accessing it in a remote way. The experimental apps run on HomeOS. User Interface for that experiment is available for any devices like phone, PC, tablet. These devices use a cloud service and have a web browser in or out of the home without any reconfiguration. That UI can be developed using HTML. To qualify the user experience, most LoT applications include a HTML page using the essential JavaScripts. The client-side web page provides easy access to application functionality.

Scouts & Drivers: Scouts and drivers are essential. Scouts detects the devices on the network and does an automatic search. The users need not to worry about communication between the devices. One scout is needed for a protocol, not for every device. Drivers understand the functionalities of devices. LoT can also use inbuilt drivers or can be created on its own. Drivers in HomeOS exports the functionalities of the devices.

HomeOS
Prerequisites for HomeOS: Windows 7, Visual Studio 2010, .NET Framework and Silverlight. HomeOS is a software that can be installed in Windows system only (Windows 7, 8, 8.1).

The HomeOS is a software that is designed like a plugin framework. The host platform and the plugin modules are the two core pieces in HomeOS. The host platform is implemented by using the Visual Studio project. That is called as Platform. Each module that is a driver or app is implemented as its own project.

Systematically, HomeOS makes little difference between drivers and applications. Both drivers and applications are referred to as Modules. Generally, driver modules are likely to communicate directly with devices and provide their services to other modules also. Application modules are likely to use the driver’s services. But a given module can both transfer its own services and use of others.

HomeOS is attached with a HomeStore, by this user can easily add acquire applications that are attuned with devices in the homes and acquire additional devices which are required to allow wanted applications.

The interesting factor of Drivers/DriverAxisCamera (for web camera made by Axis) is that it takes the IP address of

<table>
<thead>
<tr>
<th>DRIVERS</th>
<th>USAGE/PURPOSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver webcam</td>
<td>Webcams</td>
</tr>
<tr>
<td>DriverAxisCamera</td>
<td>IP cameras made by Axis Communications</td>
</tr>
<tr>
<td>DriverDlnaDmr</td>
<td>DLNA media renderers</td>
</tr>
<tr>
<td>DriverDlnaDms</td>
<td>DLNA media servers</td>
</tr>
<tr>
<td>DriverDummy</td>
<td>a “hello world” driver to play with HomeOS basics</td>
</tr>
<tr>
<td>DRIVERLocalCacheR</td>
<td>IR transmitter and learner made by GlobalCache</td>
</tr>
<tr>
<td>DriverImgRec</td>
<td>used in virtual device for face recognition</td>
</tr>
<tr>
<td>DriverNotifications</td>
<td>virtual device for sending notifications over email and SMS</td>
</tr>
<tr>
<td>DriverZwaveZensys</td>
<td>Z-wave devices</td>
</tr>
</tbody>
</table>
camera and user credentials as starting arguments. It gets the current image by exporting a port with operations and correspondingly controls the camera (pan and zoom).

**Apps in HomeOS**

To interact with DriverAxisCamera, an app called Appcamera is designed to install in HomeOS. To view the image received from DriverAxisCamera driver as well as control the camera and also it provides GUI. In starting, it looks for ports of camera, after being found it starts a thread which gets a new current image each second and renders it.

**Browser/Server (B/S) Architecture:**

The Lab of Things apps follow the Browser/Server (B/S) architecture. Browser/server architecture is internet access to the server and it can be open to all or restricted access to those have passwords. This could be a private server but with based on accessing the internet rather than LAN access.

LoT applications core functionality is written using the WCF web services. Usually, C# with Microsoft Visual Studio are used for these web services. Succeeding the usual method of creating the WCF service, an app developer must complete two C# files. One file defines the web service, the functionality of the application as endpoints/enduser and a number of web function calls as operation deals. The function calls as defined in the first file is implemented by using the second file. And that is necessary to include functions to response to five basic HomeOS events: when the platform starts, when the platform stops, when a new device is added into the platform, when an existing device is removed from the platform, and when a device related event occur is received from the platform.

**Applications**

LoT can be used for the purposes of Home automation, elderly care, paralysis patient. Let us consider a paralysis patient, who is not able to switch on/off the light. LoT reduces that barrier by providing textile based capacitive sensor. In this case the sensor being used is fixed to any cloth to the patient present in the wheel chair. The sensor works on the basis of gestures. The patient can use their hand gestures to on/off the light.

While considering the elderly care scenario in LoT, one of the challenges for senior citizens who live alone is social abuse. While seniors are known to be a helpless population, these challenges can be addressed by the Lab of Things Alerts App, a Z-Wave door sensor, web camera and relevant driver. Technically, each and every time the door opens, the LoT Alerts App invokes the web camera that looks the door to take a photograph. The image can then be sent to a dedicated caregiver through e-mail.

In case of home automation, the devices in house are interconnected. By measuring the temperature and humidity can able to open or close the window. Providing door sensor able to open/ close the door. And also by providing pressurised sensor in bed, when the person lays down on the bed, the light gets automatically off and in other case, the lights gets automatically on.

LoT can be used to develop different apps for different purposes by using relevant sensors and drivers to confirm proper use of devices. This can be a welcome innovation for many applications.

---

**About the Author**

Dr. A. Jameer Basha [CSI-F8000758] is currently working as Professor & Head, Department of Information Technology, Sri Krishna College of Technology, Kovaipudur, Coimbatore. He has authored a book on Embedded Systems and published papers in National and International Conference and Journals. He can be reached at jameer@skct.edu.in.
**Introduction**

minimization is the key. The smaller the gadget, the greater the value. Ranging from USB devices, to SD cards, the world is now looking at the “miniature” way. To keep relevant with this trend, big players have launched wearables which not only personalize the way in which a user processes information, but also provides a new thought-shift towards technology. A wearable can be defined as a small electronic device that is worn by a user. It can act like a prosthetic arm which can become an integral part of the user. A wearable can either be an independent device or can be connected to any other system(s) such as computers/ smartphones or another wearable device. Typically there is a constant interaction and data exchange between the wearable and connected device as long as the connection exists.

What happens to this data that is exchanged? As the wearable is connected to the smartphone (in this paper, we'll continue with the context of wearable being connected to a smartphone), the data stored can be further shared or processed. The data that can be stored/exchanged can range from user’s health/ fitness information, app notifications, etc. All such data is readily available in an unstructured form.

Wearables are going to create another humongous means of data capturing and seamlessly sharing it with social media. With this new flood of information to social media from wearables, it becomes imperative for it to handle this information accordingly. Leveraging social media to convert, analyze and ideate this data into meaningful statistics and innovate ways to provide new and customized technologies to the user community is the critical need of the hour.

Social media can be defined as a platform which users can utilize to create, share or exchange information and media such as pictures and videos in virtual communities.

**Abstract:** Decades ago, Internet was the “in” thing. The mobile revolution slowly took over Internet; and smartphones, today, are a necessity. Today’s world is ready to face another massive explosive shift from mobiles to wearables. Wearables are slowly garnering the momentum in the market and we have the big players such as Google, Apple, Samsung, Motorola and so on already making their footprint. With the increase in the devices, and along with existing ones, there will be a massive data explosion combined with a technological drift. What else would be the best way to channelize this gamut of data other than Social Media? Organizations involved in Data Analytics need to gear up and make optimal utilization of social media to channelize and categorize the raw/unstructured data that would be available in various forms, especially through wearables. The data/input from wearables will be highly valuable as there will be very less manipulation (the user can just tap and swipe, there is no scope to type long messages and manipulate information/feedback) and there will be factual accuracy of the information. Analytics on such factually-accurate data will open new doors for improvisation of services.

**Wearables and Social Media - The Future is here!**

Sowmya Togarcheti
Assistant Manager, Tata Consultancy Services

Nataraj Sirisilla
Consultant, Tata Consultancy Services

**Fig. 1: What is Social Media?**

As detailed in Fig. 1, social media is just not restricted to Facebook and Twitter. It is about collaboration, networking, sharing and exchange of information. It provides simplistic, accessible and user-friendly platform for information exchange; and on other hand, wearables are going to capture and generate loads of valuable information with/without user intervention. Channelizing this information to social media and then improvising and consuming it will not only open up new avenues across domains, but also change the way we look at things. This will require a paradigm shift in application and content development from technical perspective, and content analytics and consumption from business perspective.

**Wearables and Social Media**

This section describes the wearables in social media, wearables that are in vogue and the current trends.

**Trends in Wearables**

The wearable technology has been in existence since 1286. They have been evolving ever since and today, they are catching up rapidly. It is estimated that by 2015, 45 million wearables will ship, which is an increase of 133% when compared to 2014. In wearables that run third-party apps, the growth saw a predicted increase by 510% from 2014 to 2015. Twitter and Instagram have launched apps that are compatible with Apple Watch. Currently, Facebook is evaluating steps to launch the Apple Watch-compatible app; however, users can get Facebook notifications.

**Wearables in Vogue**

This section discusses the most commonly heard wearables in today’s market along with authors’ viewpoint of how they can benefit when connected to social media.

**Fitness band:** It has seen an explosive growth with the fitness freaks and others alike. This band monitors the user’s heart rate, steps taken in a day, pulse, sleep patterns etc. Based on these, it provides messages to the users on what was the day’s target and what percentage of that is remaining, how to improve sleep patterns etc.

Such information if uploaded/transmitted to relevant platforms, will help creation of novel, and personalized...
services. Social media will be the platform of choice to share this data as it provides a natural extension to the present day usage. This category of wearables will give rise to new and relevant business models in healthcare domain backed by arsenal of accurate and up-to-date information.

**Google Glass:** Google Glass is an optical head-mounted display that can display the information of a smartphone by giving voice commands as input. As it is connected to the user’s profile continuously, the data is uploaded to the user’s profile on social media. It can include pictures and similar media, location details etc. Even before its general availability, it has demonstrated tremendous utility in various domains like Healthcare, Media and Entertainment.

**Smartwatch:** The present day revolution, a smartwatch is probably the fastest selling wearable in the market. When this wearable was launched, it had to (or is still) face a big challenge in terms of user’s perception on the value it provides. Smartwatch has been launched by almost all big players in the market such as Samsung, Apple, Pebble, LG, TAG Heuer, Motorola and so on.

Again, Smartwatch as is might just remain a fashion statement or more of convenience, but the real power of it can be harnessed when connected to social media.

**Ringly:** A stylish ring with a semi-precious stone with features of a smartwatch. It syncs with the user’s mobile to notify usual notifications along with Facebook, Twitter, Snapchat etc.

This wearable device can be extended to equip the user’s location information which can be used to address the aspect of individual’s security.

A key commonality among all the above discussed wearables is that the utility and power of these multiply by leaps and bounds when connected to social media. To ensure this connectivity to social media and harness it efficiently and seamlessly, few key aspects need to be looked as discussed in the following section.

**Challenges and Plausible Solutions with Wearables in Social Media for Seamless Information Sharing**

This section briefly discusses the challenges faced to ensure seamless information exchange between wearables and social media, and followed by useful analytics on the information exchanged.

These are illustrated in the figure. They are Content Customization, Application customization, Data Modeling and Analytics.

In the era, where product reviews and feedbacks are manipulated, such factually-correct information will be critical to analyze and implement new techniques. It might mean development of new UX controls to both display and consume content from wearables.

**Application Customization**

Smartphones did not really take off and reached the usage levels as they are now, until customized apps were designed. Apps were developed to provide enhanced user experience when compared to the standard way of using the web pages/applications on desktop. On these lines, apps have to be customized for wearables; they can be simple widgets/motifs taking into consideration the real estate available, processing power, usability. We can term these wearable apps as “WAPPS”. If one aspect is to have customized WAPPS, what follows is the ease with which those WAPPS can be developed and deployed onto these wearables. App development has already seen this cycle and the same can be replicated to have single development environment which can dole out web application, Apps and WAPPS.

**Unified Development environment with a WAPP Engine** is the key to success of rolling out WAPPS in turn making wearables active contributors to information exchange on various platforms including social media.

**Provision for Wearable’s Data on Social Media**

Data generated and exchanged by wearables is distinct in nature and has to be handled and processed accordingly on the receiving side too. Factors such as quality, quantity, and security of data make it distinct. Data from wearables will be crisp and less subjected to manipulation, there by producing highly-authentic and good-quality data. Given the anticipated proliferation and nature of wearable to collect data almost every other second, amount of data getting exchanged continuously will be very high.

Data captured by wearables is more personal. Wearables being natural extensions to mobile devices, data exchange by wearables with social media will also follow the way it is done by mobile devices. Given the quality, security and voluminous nature of data, appropriate provisions have to be integrated into social media platforms. One possibility is to have segregated container for data coming from
wearables to ensure data security and also give an option of selective sharing of data once available on social media platform, it being the natural extension.

Fine tuning of Analytics for wearable data on Social Media
Analytics plays a key role when it comes to usage of data on social media and it is no different with wearable data on social media too. Analytics in this case has to be fine-tuned as the quality of data is high due to less scope for manipulation, it will be relatively well-defined and also the volume of data will be high. Not only the processing methods of Analytics engine, but also the result of analytics has to be customized if it has to be pushed back/presented on wearable. Analytic engines would need to include support both from technical and functional perspectives, technical to handle the distinct nature of data and function to handle the new domains trying to leverage this data. As wearable devices mature there is a possibility for simple analytics on the fly in wearable itself again fine tune to kind of activities possible form the device.

Future of Wearables and Social Media
Wearables face unique challenges while creating their footprint in the market. It can be the user’s perception of the wearable or the hindrance in adapting to the new technology or security or health and safety concerns.

However, overcoming these challenges, we have seen the wearable revolution in the past decade. Ranging from Bluetooth headset, iPods, to the most recent Google Glass, Fitness monitors, smartwatches and Ringly, the wearable market has seen a promising explosion. It has reassured that wearables are here to stay and they are the future.

Along with facing unique challenges in establishing a footprint, it also presents unique opportunities. These opportunities if combined with social media will carve a new promising future, predominantly in services sector. To adapt to this change, it is critical for all the players to evolve and ensure that they reach and influence their target audience. This adaptation can be in terms of hardware, UI controls, content, data security, improved user experience in terms of WAPPS.

Advertising and Marketing
As a prerequisite, it is important that players adapt to certain challenges such as messaging and UI. For example, a user might not be interested in “click to know more” on a smartwatch; or, pop-up ads. The size of icons, buttons etc., on the UI should be customized to create an appeal. On addressing these challenges, advertising domain can tap the “wearable customers” and collect the required information for analytics.

For example, let us consider the use case – The customer visits a coffee shop and this coffee shop has an app to collect the feedback. The app can prompt a series of questions for feedback. Analytics can be applied and the feedback can be analyzed.

The conclusion is to stay relevant to the user, getting to know the user base and their preferences which help in gauging what the user is expecting.

Healthcare
In the recent past, wearables have garnered a lot of interest and customer base in Healthcare. Players have cashed in on the fitness fad among users and have come up with fitness bands, fitness monitors etc.

A Fitbit flex or any similar wearable will collect information such as heart beat, pulse, BP levels, etc. All such data will be stored in the user’s smartphone. If we consider this data being uploaded to user’s profile on social media, it presents several opportunities in the healthcare and insurance world. By applying analytics on the available data, the players can create customized health plan, health advice, and healthcare services to users.

In post-operative care, wearables use similar technologies for a different purpose. These wearables help doctors to monitor their patients’ post-hospitalization health, track their movements and allow them to send their vital parameters information.

Healthcare sector will have access to the kind of data it never had, thanks to wearables, and data exchange on social media, auxiliary service in healthcare can provide customized services to customers. For example, with fitness data accessible on social media, fitness centers can device customized plans, suggest relevant nutrition or pump offers relevant to users’ area of interest in fitness. With usage of wearables and data exchange with social media, healthcare and insurance sectors can make a real difference in servicing their customers.

Banking
Since ages known, Banks have been the richest repositories of data. However, all this information is of no use unless it is put to use. We now see the perception shift of users from going to a Bank for a transaction to online banking and most recently, the mobile banking. The Banking industry too is trying to establish their footprint in wearable market. This adaptation can see quicker ways in which a user can transact with a bank – be it balance transfer, pay utility bills or apply for loans – the time involved will reduce drastically. For example, it can be convenience for a user to receive the OTP on smartwatch instead of receiving it on mobile while transacting using the mobile. It is difficult to switch between apps to check the OTP and validate it. Instead it can be made simple by looking at smartwatch and entering on the mobile.

Banks can also launch their products, collect feedback, increase the sales and so on through this technology.

Wearable Banking demands high security. For the banks which adopt this technology, it is critical to look at the security loopholes that can be misused and then only launch their apps.

The banking industry should create stringent set of rules for all the organizations which are looking forward to tap the potential of this new technology in the market.

Fashion
Wearables have entered the Fashion industry more than a decade ago when smart fashion was unheard of. From LED dresses to think jackets to present day’s Ringly, the world of fashion is going the smart way. The Fashion industry is indeed seeing a lot of startups working on this technology.

The smart dress will be connected to the mobile phone. As the connection is alive and continuous, the notifications of the apps and messages are linked to the dress the user wears. For example, Ringly, a ring, flashes every time there is a notification.

However, how do we fit the social media here? Can these smart clothing which talk to the mobile also talk to the user’s profile on social media? In today’s scenario where an individual’s security is utmost important, the Fashion industry should create a wardrobe that is not only fashionable but also “smart.” It can leverage the most important piece of information, “location” that a wearable can transmit, and launch smart clothing and apps that can accept the location info and send a
notification to all concerned in case of any attack. All this will definitely be possible if we build the Intelligence module of the wearable with the necessary capabilities.

**Conclusion**

With the new technology shift, it is important that all of us adapt to it at the earliest. The users have to shed the apprehensions of migrating to a wearable, specifically about being connected to social media and their perceptions of how a wearable can benefit them. Wearables have started to make a mark and are here to stay and become integral part of our daily lives.

This is going to be next technological wave after smartphones and what is important is reassuring the success of this revolution and building the confidence and loyalty in the user base. A paradigm shift is necessary from both sides – users’ adapting to the new technology and players by thinking in the future and cashing in on the new technology to establish a footprint. Wearables in conjunction with social media is going to change the way services are provided and consumed across sectors. We are close to world of magic in day-to-day lives with wearables and social media.

It will be like this one day! On a lazy Sunday morning, I will receive an alert from my gym instructor to show up at the gym early, by an hour, because my instructor had been alerted by my doctor that I had a heavy dinner the previous night and I need to shed those extra calories!

**References**

[2] https://www.cite.co.uk/the-different-types-of-social-media/

---

**About the Authors**

**Ms. Sowmya Togarcheti** [CSI – 1160501] is working as an Assistant Manager in Tata Consultancy Services. Her core competencies include documentation consulting, customer and stakeholder management, technical writing and reviews, training, and process implementations. She has received several accolades for her dedication and support. An avid reader, she prefers spirituality and political journalism. She can be reached at sowmya.togarcheti@tcs.com.

**Mr. Nataraj Sirisilla** [CSI- 1160504] is currently working as a Consultant - Presales and Solutions in Tata Consultancy Services. An avid gadget-enthusiast, he is passionate about enterprise mobile solutions. He can be reached at nataraj.s@tcs.com.

---

**Interview on Open Source Technologies**

Prof. Raj Kumar Buyya, Director, CLOUDS, University of Melbourne, Australia

By Srinath Rampur, Chairman CSI Mysuru Chapter

---

1. **What do you think about Open Source?**

   Open source basically allow you to see the code base, the way they have implemented it can be free or paid also. Some of the Companies can give source code if you want just for your own use in case you want to look or modify.

   If there are problems coming up, quickly the customer can identify and solve themselves they can modify the code and use it. This is the real benefit of Opensource. If the new devices are coming up the company which created the software and that software is not able to work with new device, the customers can take care.

2. **Any open source for Cloud Computing?**

   Yes! Opensource depends upon what you are looking for. If you want to simulate a cloud environment then you can use CloudSim which is open source or looking for just model of programming like Mapreduce you can use software like Hadoop. If you are looking for infrastructure management basic level you can use Openstack, but you can also get better capability in commercial solutions which are not open source. However they are built for enterprise keeping in mind, they have their own advantage. With opensource you are alone most of the time, if there are some problems- you do not know whom to talk to. They may not be customized to your requirement, they are available but they bring their own challenges.

3. **What are the employable opportunities for experienced Opensource techie?**

   Not all Enterprise solutions are built on Opensource, it is a concept, it doesn’t matter, whether you use Opensource or commercial software. It really doesn’t matter. Linux is an Opensource. It’s another UNIX operating system you don’t really know inside what is happening, you have a deployable software incase if you want to look at inside code, you can look at which most of the people don’t do it. Therefore if you are good in concept very clearly, so we should be able to work either in companies which use commercial or Opensource, you can always learn some Semantic that change that can be learnt in few days. The important thing is understanding the fundamental concepts and basics. It is not about Opensource or commercial.

4. **Now lots of people are talking about Opensource, what your opinion on Opensource and commercial?**

   Computer industry will burst if there is no commercial software. If everybody want everything free then who will pay for it? The maintenance, extension, taking care and handling customers. People are always spending money, it’s a question of whom they are giving and where they are spending money, both will continue to exist (commercial and so Opensource too).

5. **Any suggestion for the new generation about Opensource?**

   Generally there are two things, one is usage and second one is a development.

   If younger generation wants to build a small tool so they are not commercializing! Then they can release as Opensource, in case if they are not able to extend others will extend, Like for example CloudSim-cloud simulation software which we developed, we had no plan to commercialize it so we made it as Opensource, people are extending and developing new models for it, taking care of it which is really good. If I had not shared the code as Opensource it is less likely that these innovations would happen. I think it depends on situation to situation if you are not going to do it yourself, if you created one so share it as Opensource. If it is useful, the community will maintain it, if not it will abandoned.
A wireless sensor network is a collection of nodes organized into a cooperative network. Each node consists of processing capability with help of microcontroller, usually a flash memory and have a RF transceiver (usually with a single Omni-directional antenna) powered by a power source, and has an array of sensors and sometimes actuators. The nodes communicate wirelessly and symbiotically based on a pre-defined routing protocol. The networks have 1000s and sometimes even more than 10,000 nodes which are integrated into a system.

With the internet backbone, the spread of wireless sensor networks is fast growing and is evolving with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces.

Wireless sensor networks have an extremely useful application especially in the rural areas where grid power is scarce in agriculture has described an application in the rural areas where grid power is extremely useful application especially smart spaces.

Transportation, entertainment, crisis including environmental, medical, military, potential for numerous application areas growing and is evolving with unlimited spread of wireless sensor networks is fast system.

10,000 nodes which are integrated into a 1000s and sometimes even more than the nodes communicate wirelessly and symbiotically based on a pre-defined routing protocol. The networks have 1000s and sometimes even more than 10,000 nodes which are integrated into a system.

With the internet backbone, the spread of wireless sensor networks is fast growing and is evolving with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces.

Wireless sensor networks have an extremely useful application especially in the rural areas where grid power is scarce in agriculture has described an autonomously powered system where they have used solar photovoltaic and rechargeable batteries as an energy source for the electrical equipment. The application of this system is to enable remote monitoring mechanism of soil temperature, soil moisture etc. Irrigation valves can be activated to water the field based on the input received from the sensors.

Another application in which WSNs are used is for studying the movements of animals in National Parks. Breeding behavioral studies of birds was undertaken by using sensor nodes installed inside burrows and tree holes. Nodes to measure humidity, pressure, temperature, and ambient light level were placed. Some sensors had infrared motion detection sensors. These were organized as local cluster networks and each cluster had a node fitted with a long-range directional antenna to pass cluster data to a base station. Nodes fitted to larger sized wild animals like zebra with a wide area coverage of roaming was considered in. Each node logs the animals behavior and environment and passes data to any other node which comes within range. At regular intervals, a mobile base station (e.g., a car or a plane) moves through the observation area and captures the recorded data from the animals in the vicinity has shown monitoring the positions of cattle and using “virtual fences” created by an acoustic stimulus to discourage an animal from crossing a defined line. The network of nodes are connected to a base station so that feeding behavior can be monitored and virtual fences adjusted to improve usage of the feedstock.

Green computing refers to harnessing the capabilities of Information Technologies (IT) to minimize the negative impact on the environment, which is generally achieved by reducing the CO₂ emissions in the manufacturing processes as well as their energy consumption by the computational devices. WSNs being energy hungry, have always been aimed towards efficient management of each architectural layer involved in the process of WSN application building, from the hardware to the application itself.

A sensor node is typically powered by limited-capacity batteries. The batteries are the power source for the sensor node’s circuitry for carrying out various operations by their components. A sensor node is a platform that integrates components like radio transceivers, transducers, microcontroller, and flash memory, each of which may operate periodically and may have different energy requirements depending on the state of the sensor node. The sensor node energy consumption is calculated as an aggregate of the energy consumption of individual components for a certain state. The sensor node lifetime is the time taken to discharge its battery below the minimum charge level that is required to sustain the sensor nodes operation.

To free up the constrained energy resource in wireless sensor networks, researchers have directed their efforts towards researching on energy harvesting to power the sensor nodes. However, practically energy harvesting has a cyclic nature as it depends on energy sources from the environment which is beyond the control. Thus, a complete dependence on this form of nature may not be sufficient to power the sensor nodes. A hybrid combination with a pack of rechargeable batteries is still necessary. The excess energy through the energy-harvesting system is stored and used when the energy harvesters are not able to produce the power. However, it may sometimes happen that the battery is not able to be recharged in time and the sensor node is unavailable.

Efforts to minimize or avoid such periods is the next challenge towards managing the energy harvesting in wireless nodes. has proposed rechargeable batteries and super capacitors in combination with photo voltaic cells. Further also undertaken a comparative study of various MAC protocols with the energy harvesting methods and has stated that the energy harvesting methods in wireless sensor networks can be chosen based on the applications and can prolong the life of a network.

Energy Harvesting-based WSNs (EHWSNs) as they are called WSN nodes equipped with capability of extracting energy from the surrounding environment which could be solar power, wind, mechanical vibrations, temperature variations, magnetic elds, etc. Continuously providing energy, and storing it for future use, energy harvesting subsytems enable WSN nodes to last potentially forever.

There have been corollary studies with regards to battery life prediction using RSSI and also by transmission power and voltage relationship using battery models. Sensors energy can be conserved if an optimum routing protocol is employed. In case of environment
dependent energy sources, the routing protocol can define the dark hours for performing the sleep cycle of the sensor.

There are a number of combinations of energy and conversion devices which have been explored towards energy harvesting\[^{10,11}\] and the same are being categorized for specific applications depending on requirement of suitable voltage and current level since conversion between voltage levels implies some dissipation of energy. Certain conversion devices can be scaled like the photovoltaic (PV) cell, where more elements can provide more power. While scaling up a conversion device is an option, the space constraints of a node might be another important design factor depending on the node application. Thus, in assessing power density, the volume and weight of associated energy storage may also be important.

The various types of energy sources available for scavenging are:-

(a) Electro Magnetic Radiation - Photo Voltaic (PV) devices efficiently convert visible light to electrical power with a relatively high efficiency and also over a broad range of incident wavelengths. These devices are relatively low cost and are able to provide voltage and current levels that are close to those required for microelectronic circuits.

(b) Thermal - Thermal gradient or the difference between the energy levels of the source and the sink is the driving force behind efficient extraction of energy from a thermal source. Facilitating a gradient within a compact environment is a challenge and therefore not suitable for Wireless Sensor Networks.

(c) Mechanical Energy Sources - Steady state mechanical sources - Mechanical energy in the surroundings transferred due to relative motion between the two elements in form of flow of wind and air currents and flow of water like in rivers, waterfalls, tidal waves, dams and irrigation projects, water supply pipes or even sewerage. Typical method being converting this energy into a rotational movement through a turbine which in turn drives an alternator to generate power.

Intermittent mechanical sources - Energy sourced from a cyclic motion in nature but which is available for a short duration. Examples of this type include energy available from vehicles passing over an energy harvesting device\[^{12}\] and human activity like walking, running, cycling, rowing. Even footfalls at a subway station have been identified a potential source of power.

Vibration - Vibration energy is available in most built environments. Depending on the amplitude and frequency of vibration the energy that can be extracted. It also depends on the extent to which the presence of an energy harvesting device affects the vibration.

Solar Power (Electro Magnetic Radiation)

Solar provides an excellent source of energy for wireless systems that have no access to fixed power. Solar energy is almost infinitely available and depending on the location on the earth, almost throughout the year without cloud obstructions. Green technology being the focus of the modern world and the alternative energy sourcing, i.e. the Solar or Photovoltaic (PV) cells continue to improve exponentially both in efficiencies and lowering production costs. Almost on an average 1000 w/m\(^2\) of solar energy falls on the earth in best weather conditions. Therefore outdoor wireless applications can surely tap into this perpetual energy source.

PV cells are rated to produce a given current and voltage output when illuminated with a standard light level (irradiance) of 1000 Watts/m\(^2\). The current produced by the cell is directly proportional to the active area of the cell (in \(\text{m}^2\)), the amount of light falling in that area and the conversion efficiency of the cell.

The PV cells have a limited ability to collect energy only during the day and therefore energy storage devices have to be integrated to ensure availability of power when no light is available. Amongst the many battery technologies Lithium Ion secondary cell is found to be the best choice. Li-Ion batteries have excellent energy storage capacity and long charge/discharge lifetime characteristics. They have the additional virtue of providing 3.6 volts - a very handy value for powering typical WSN 3.3 volt modules.

There are other factors with regards to the energy availability in a solar powered wireless sensor network like the weather effects, Short scale urban shadow effects, seasonal effects especially in higher latitudes, Debris, dust, humidity and salt accumulation depending on the working environment of the network. Battery condition and remaining capacity also impacted by temperature variations in the environment. Since, a battery that has a lower capacity is more likely to be discharged deeply during its future operation, the differences between batteries tend to get worse over time.

To enable energy aware sensing, computing and communication schemes\[^{13}\], it is critical to be able to accurately forecast future (medium-term) power availability, and to estimate the current battery condition. This would go as a parameter in the routing protocol which would task the sensor network accordingly to optimize the network life within the available energy resource. Estimating the power availability in real time has additional benefits, for instance to detect faults in the battery, solar panel or charging chip. This early detection allows the optimization of the remaining energy of the node to allow enough time for its repair.

Conclusion

Wireless Sensor Networks are always resource hungry and the energy being the prime amongst them. Energy harvesting from the environment is an attractive method of meeting these energy requirements. With a good understanding of the nature of the various energy sources and of the conversion mechanisms available, an optimized energy solution for a particular type of wireless application can be definitely developed. Teamed with an intelligent routing protocol, energy harvesting has thus become a key research area towards enhancing network availability. The article has made an attempt to trigger a thought towards this direction.

References


---

**About the Authors**

**Ms. Pritee Parwekar** [CSI-I1503025] is working with Dept. of CSE of ANITS, Vishakhapatnam. She has more than 15 years of teaching experience. Her research areas are Sensor network, Cloud Computing and IoT. She can be reached at pritee2000@gmail.com.

**Dr. Sireesha Rodda** [CSI-I1503026] is currently working as Associate Professor in Computer Science and Engineering department, GITAM University, Visakhapatnam. Her research interests include Data Mining, Artificial Intelligence and Big Data Analytics.

**Dr. Suresh Chandra Satapathy** is currently working as Professor and Head, Dept. of CSE, ANITS, Vishakhapatnam. He is the editorial board member of several proceedings with Springer. He holds the Chairman Div-V(Education and Research) position in CSI. His research interests are Data mining, machine Intelligence, Swarm Intelligence and Soft Computing. He can be reached at sureshsatapathy@gmail.com.

---

**Inauguration of CSI Student Branch at Dr. K. V. Subba Reddy College of Engineering for Women, Kurnool**

CSI Student branch at Dr. K. V. Subba Reddy College of Engineering for Women, Kurnool was inaugurated by Shri Mr. K. Ashok Vardhan Reddy, Chairman on 16th October, 2015 and it was graced by Dr. Haris Krishna, Director. Mr. Mahesh, HoD, CSE Welcomed everybody to KVSW and he stressed on the need for students to associate themselves with organizations like Computer Society of India. Sri Raju Kanchibotla, Regional Vice President of CSI attended the programme as Guest of Honour and spoke about the different activities of CSI. He stressed on to organise different tutorials, seminars, conferences and for which the student & faculty community will be benefited. Then Mr. Krishna Kishore delivered a talk on “Digital India and increasing opportunities in computer field and the skill set required to acquire them”. Prof. Rama Rayalu, delivered the key note address on time management and importance of IT in different areas. He inspired the students to try answering such questions, which have not been answered yet by going deep inside the problem.

The inaugural function came to an end with a vote of thanks by CSI student SBC Mr. Dr. K. Pavan Kumar. More than 200 students were present in the programme.
Write Your Own Program: Demystifying Computer Programming for Amateurs

Subrata Ganguli
Guest Professor, Consortium for Training, Research and Development, Kolkata

Dhrubijoti Sharma
Ph.D. Scholar, Centre of Cognitive and Behavioural Sciences, University of Allahabad, UP

With the emphasis of computer education in the curriculum of all disciplines, working knowledge of computer programming had become a must. We cite herein a few programs that were written by advanced undergraduate students to facilitate teaching in their own class. In addition to their function as a tool to aid in self learning, the practice also offers a way of better utilization of hardware as well as open source resources; and an opportunity for gaining before-the-job training experience, reducing the gap between rural and urban students.

Introduction
Open access software permits us to employ programs written elsewhere by authors all over the world. They are available free of charge. They could be used as it is, or one may even at times modify the content to suit to one’s need. The vast resource of open access software had reduced the expenditure of computer-based education in the age of web-centric globalization. They had also made computer education feasible in the rural and economically poorer neighborhood. Thanks to the open source applications, students enjoy the benefits of a paper-less lifestyle. However, one may make use of the available resources to train students writing small programs to improve their computer literacy, especially for those who are not majoring in computer sciences. In addition to training, the senior author uses open access software and resources routinely for research in biotechnology,[1] habit of writing small programs,[2] can change the black box of computer resources to a grey box.

However, open access resources come with concern over their accuracy and computer security. Whatever is available for free has to be validated as authentic. The fear of applying wrong data, misunderstanding of computer jokes, and use spurious software always remain an impediment to the purpose. Accordingly directory of authoritative sources of information are maintained at several governmental and high profile sites. Table 1 is a list of sites that are maintained by competent supervision and are in use in authors’ group.

Open access utilities online reduce the need for storage and downloading, and can be worked with a mobile or on a tab or even at a cybercafé on rent. These are of benefit to the rural students without a house in the city. Mass penetration of rural information and communication technology is limited in its utility by the ability to communicate in non-vernacular languages. Issues related to ambiguity in translating and retranslating Indian phrases into English and back had often been discussed.[3] Mobile and web-based technologies with the benefit of open access utilities are reducing the distance in terms of globalization thereby asserting some equality in opportunities among the rural and urban students, imparting competitiveness among the rural children. These topics though appear simple in content, have immense potential in popularizing computers and computer languages in the rural sector.

In the age of info technology, we are overwhelmed by the number of computer applications we deal with. One wonders whether it belittles the creative human mind behind the writers of the software. To counter this awe of advanced technology, educationists had always recommended teaching of computer programming in all branches of science and engineering. Working knowledge of the web, internet, database, programming languages etc. had now become a must even for non-computer professionals. To illustrate the penetration of computer applications in the undergraduate curriculum of biotechnology, this paper is written by students and faculty from the department of biotechnology. As the topic of programming was being introduced to the biotechnology students, some of the students with the help of their teacher wrote computer programs themselves. Its immediate goal was to teach computer programming to junior students; but its long term aim was to encourage students to write small packages themselves so that they could overcome the fear of computers. The approach makes use of computer terminals available in the college, thus enabling better utilization of resources.

In this communication, we enlist a few open source resources that are used by teachers and students alike in the field of biotechnology and bioinformatics. Students also are encouraged to write programs to suit to their needs. A few examples of students’ projects are also cited. It is hoped that this approach would complement the training of the students availing the awesomely vast and ever increasing open access resources.

Open Access Resources
Biotechnologists routinely use a large number of open source resources. It provides access to authoritative data, publications and other resources. Open source programs written in C and PERL are very widely used. Table 1 is a list of a few open access resources utilized by authors’ group.

Methodology for Writing of Students’ Programs: The emphasis by the teacher was to develop the analytical and programming skills by the students, so that they can distinguish between mathematical and algorithmic logic, and follow up on the programming languages. The feat is not always trivial in a department where students are not majoring in computer sciences. However, understanding of the mathematical procedures behind the numerical methods was not required. The exercise is very flexible, adapted to a workshop format personalizing the experience.

Accordingly the students are given a physical problem. They are asked to think about statement of the problem, look into references, design the flow diagram, write the program (usually in C) then debug and run the programs. While the students had to consult the basic tutorials and textbooks on C-programming, they had to acquire the skill of problem solving. Moreover programs were meant for the...
laptops written during the leisure at home, while getting used to LAN and the web.

Example of Student Projects on Programs
The students projects were carried out to improve their learning skill while remaining complementary to the available vast resources. This approach would permit the students to utilize the open access resources in a wise and accurate manner. The approach also involved direct problem solving boosting the confidence of the undergraduate students.

Momentum Transfer Calculations\textsuperscript{[2]}:
This particular program was written by an undergraduate student of Biotechnology in the Nagarjuna College of Engineering under the supervision of Dr. Subrata Ganguli and was presented in a conference\textsuperscript{[2]}. The goal was to calculate the terminal settling velocity of a particle falling through a liquid taking into consideration the appropriate shape factor. That would help model the mobility of aggregates of bacterial cells and fungi of different shapes and sizes as combinations of cylinder and spheres. In fact during the presentation, live demonstration was made to accommodate the request of the audience to alter the program so that the audience could become interactive participant. The approach was quite successful.

Harsha\textsuperscript{[4]}: A software computation package for teaching in Biotechnology and

<table>
<thead>
<tr>
<th>Source Site</th>
<th>Description</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.ncbi.nlm.nih.gov/">http://www.ncbi.nlm.nih.gov/</a></td>
<td>National Center for Biotechnology Information</td>
<td>Authoritative source of data and software used in biotechnology and bioinformatics</td>
</tr>
<tr>
<td><a href="http://www.ebi.ac.uk/">http://www.ebi.ac.uk/</a></td>
<td>European Bioinformatics Institute</td>
<td>Authoritative source on data on biological systems</td>
</tr>
<tr>
<td><a href="http://www.expasy.org/prosite/">http://www.expasy.org/prosite/</a></td>
<td>Bioinformatics resource portal</td>
<td>Source for analysing patterns and motifs in protein structure; provision for modeling of protein structure</td>
</tr>
<tr>
<td><a href="http://kinemage.biochem.duke.edu/">http://kinemage.biochem.duke.edu/</a></td>
<td>Duke University site for molecular modeling</td>
<td>Useful for 3-D structure of macromolecules</td>
</tr>
<tr>
<td><a href="http://www.rbvi.ucsf.edu/chimera/">http://www.rbvi.ucsf.edu/chimera/</a></td>
<td>UCSF site for molecular modeling</td>
<td>Useful for molecular modeling of 3-D structures</td>
</tr>
<tr>
<td><a href="http://www.rcsb.org/pdb">http://www.rcsb.org/pdb</a></td>
<td>Protein Data Bank</td>
<td>Authoritative information portal to biological macromolecules</td>
</tr>
<tr>
<td><a href="https://doaj.org">https://doaj.org</a></td>
<td>Directory of open access journals</td>
<td>Indexes and provide access to peer reviewed journals</td>
</tr>
<tr>
<td><a href="http://www.opendoar.org">http://www.opendoar.org</a></td>
<td>Directory of open access repositories</td>
<td>Authoritative directory for academic open access repositories</td>
</tr>
<tr>
<td><a href="https://www.perl.org">https://www.perl.org</a></td>
<td>PERL language</td>
<td>Primary site for accessing PERL software and modules, often useful in biotechnology and bioinformatics.</td>
</tr>
</tbody>
</table>

Table 1: Few Widely used open Access Resources

---

Fig.1: A simplified diagram to illustrate the procedure of writing a program for calculations involved in a physical process or a biological system. The steps involved (a) understanding and modeling the phenomenon, (b) clear statement of the problem, (c) Formulation of mathematical expression (d) drawing of flow diagram (e) writing the program (Source code) (f) running and debugging. Interaction with databases is required. Generations of programs become increasingly complex as the students acquire more knowledge and access to accurate databases.
Chemical Engineering curriculum, Harsha, was a collection of programs[4]. The programs were originally written by the fourth year students to help in teaching of C language programming for the second year students. Accordingly, they were made simple, interactive and relevant to their curriculum. The collection contained 9 programs as follows:

- Heat Exchangers: simplified process and mechanical design of a heat exchanger.
- Agitators: simplified calculations of an agitator.
- Death kinetics: calculations of thermal death kinetics of microorganisms.
- Holding time: calculations of holding times during the cycles of sterilization.
- Genetic Variance: Calculations of genetic variations.
- Degree of Reduction: calculation of degree of reduction from a chemical formula.
- Unit conversion: simple conversion formula for interchange of units.
- Runge Kutte method: a simplified algorithm for this numerical method.

The project was successful in training students in the same college. Authors also explored the option of patenting the embedded software.

Concluding Remarks
The approach was popular among students since they were learning to apply their knowledge in computer programming as well as with the processes and phenomenon taught in non-computer subjects. This helped them overcome the fear of computers and at the same time making the work interactive avoiding excessive memorization and bookish learning. The approach was made flexible to accommodate the idea of LAN and the Web, while working on the laptops. As a result the students could utilize the available hardware and open access software to their satisfaction. Moreover, employers might find the students already having a project work experience up to one year, before they took jobs in any company, thereby reducing the gap in skills among the rural students.

References

About the Authors
Dr. Subrata Ganguli [CSI-00174427] was a Professor in the Department of Biotechnology, Shridevi Institute of Engineering and Technology, Tumkur, Karnataka. He was educated at the IIT Kharagpur, IIT Delhi, and the University of Illinois at Chicago. He was the top ranker in his B.Tech. (Hons.) class in Chemical Engineering. He has more than ten years of teaching experience and over 10 conference and journal papers to his credit. He can be reached at vvbusy@yahoo.com.

Mr. Dhrubyoti Sharma is currently pursuing Ph.D. at Centre of Cognitive and Behavioural Sciences, University of Allahabad, UP.

1st International Conference on Computational Intelligence & Informatics (ICCII-2016)
28th – 30th May 2016
Organized by Department of CSE, JNTUH College of Engineering Hyderabad
Venue: UGC ASC Auditorium, JNTU Hyderabad, URL: http://www.iccii.net

Call for Papers / Participation
The world today is more dependent on technology than ever before, and Computational Science and Information technology are basic building blocks for most of the technologies. Research in the area of Computational Science and Information technology is moving at a fast pace and it has become very important for Scientists, Researchers and Academicians to perceive the latest developments.

The First International Conference on Computational Intelligence and Informatics (ICCII) is focused on promoting the recent advances and innovations in the disciplines of Computer Science and Information Technology. The Conference offers an opportunity to bring together scientists of different disciplines, to discuss new issues, to tackle complex problems and to find advanced solutions breeding new trends in Computational Science. This Conference will also provide a platform for research community and industry to share the recent developments, and to discuss about the discoveries in computational intelligence and informatics.

ICCCI-2016 invites papers of research on the topic of the following tracks:
- Data Mining and Data Warehousing
- High Performance Computing
- Parallel and Distributed Computing
- Computational Intelligence
- Soft Computing
- Big Data
- Cloud Computing
- Grid Computing
- Cognitive Computing
- Image Processing
- Wireless Networks
- Social Networks
- Wireless Sensor Networks
- Information and Network Security
- Web Security
- Internet of Things
- Bio Informatics
- Geo Informatics
- Computer Networks
- Other topics related to ICCII Theme

Queries
convener.iccii2016@jntuh.ac.in, convenericcii2016@gmail.com

Address for communication
Convener, ICCII-2016, Dept of CSE, JNTUHCEH, JNTUH Campus, Kukatpally, Hyderabad - 500085 Phone: 040-23158661 Ext 4444

Contact
7680995513, 9000899779, 9885447701, 9246874862

Important Dates
Determining Maturity Level of a BI (Business Intelligence) Application

Manish Kumar
Associate Consultant, Tata Consultancy Services Ltd., Bhubaneswar

Ranjan Sarangi
Senior Consultant, Tata Consultancy Services Ltd., Bhubaneswar

Introduction - The Purpose of BI Systems Today’s World

In the early days of information technology (IT) era, the business enterprises invested in IT to develop and use normal transactional systems. They used such systems to record and retrieve information as necessary for their day-to-day business operations or transactions. Such transactional systems had very basic elementary reporting features to satisfy timely (or current) needs of the business house. There was no thought to secure or shape the future in a scientific manner.

Over the period of time competition catches up. In the pursuit of innovation and simplicity, numerous start-up business came up. Some went on to become mammoth brands on their own. In the pursuit of growth larger business houses acquired some smaller ones including start-ups. During all these happening, a complementary phenomenon also was happening primarily as a cause and secondarily as a consequence to the evolution of the business houses. This complementary phenomena includes change of purchase and behavior pattern based on shift in socio-economic-cultural status of people (or consumers) across different geography in many different manner.

Now we are talking about accumulation of huge amount data in the transactional systems over a long period of time cutting across many dimensions and many events ranging from those relevant to business houses and also those relevant to the consumers.

This huge accumulated data or information is priceless. Business houses wanted to leverage this information to take business decision for future and carry out root cause analysis of business performance metrics. Thus, was the dawn of business intelligence systems or business decision support systems. Many IT vendors have built their own proprietary model (architecture, design) for BI systems are established in market. Many IT vendors continue to build new BI systems using open source technology or community driven technology. Some offer USP (unique selling point) as cost, some offer USP as efficiency or performance, some offer effectiveness and scalability, some offer USP in specific business domain or specific technology domain.

Then, considering the volume, veracity and velocity of data of modern day business, the BI systems are also modifying their architecture/design to provide features that really makes a connection to the buyers of BI systems.

A BI system is increasingly taking a position of necessity (must-have) than luxury (good-to-have) for business houses regardless of their size and customer base. This is what would help businesses remain in business. Forward thinking CEOs, CIOs, and CTOs of business houses, before commissioning any transactional system, go through a check list to ensure - one (or more) BI system is procured, or at least present in their IT eco-system, in order to do the necessary analysis of their transactional systems/data. This is now new normal. This would help the CxOs take decisions to increase top-line and bottom line, cut-down fat in terms of processes and resources, increase ROI (return on investment) at macro level as well as micro level (even for a single customer interaction), increase customer base, increase customer loyalty, improve customer experience and in the process demonstrate true value proposition to customer at every opportunity of interaction.

With growing need of having a BI system in IT eco-system of a business house, the IT vendors are offering multitude of options of BI systems; the CxOs or the IT managers definitely need guidance or advisory service before they choose a BI system. It could be short, medium or long term investment depending on various aspects of their business and current IT eco systems. This article describes a ready-to-use mechanism that attempts to make the choice or at least guide the selection process of a BI system. The mechanism makes use of a template with multiple set of relevant and inquisitive questionnaire that need to be answered for the BI system being evaluated. The answer/response need to be given by the architect and or the business owner. Based on responses to questionnaire the template returns a score or maturity level definition for the BI system. The short and long description of the maturity level guides the selection process. The template is flexible or scalable to add questions on additional aspects of the selection processes as the situation may demand.

Below are the details of mechanism or procedure for using the template and then arriving at maturity level of a BI system.

Goal: Objective is to determine the level of maturity for a BI product or application by doing assessment with respect to modern day computing practices and business value output.

After evaluation, a BI application can be put in to one of three levels e.g. Matured, Acceptable or Experiment optimistically where “Matured” is best desired state or level of an application.

1. Procedure: A template, in MS excel spread sheet, is made. This essentially does the following:
   - Enlists a comprehensive list of relevant and inquisitive questionnaire about the application;
   - Allows the architect(s) of the BI application to record response to each question and then
   - Returns %age scores for various categories of questions as well as for the overall application. The overall %age score is average of %age score of all categories.

   The computed over all %age of score is measured in following scales and conclusion is made in terms of conformance to best standards of BI applications.
2. **Meaning of each level of maturity**: Meaning of maturity level from the application perspective is explained in below table.

<table>
<thead>
<tr>
<th>Level</th>
<th>Range of score</th>
<th>Degree of Maturity</th>
<th>What it means for the BI application being assessed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3</td>
<td>90% &lt;= Score &lt; 100%</td>
<td>Matured</td>
<td>The BI system is a comprehensive, inclusive, accurate, easy to use, giving good visual experience, scalable, configurable, a performant Application, with minimum production support available for all customers. From the perspective of richness of application features - The features of such BI application meets requirement for most of the referential* customers.</td>
</tr>
<tr>
<td>Level 2</td>
<td>75% &lt;= Score &lt; 89.99%</td>
<td>Acceptable</td>
<td>Such BI system is an acceptable performer, provides reasonable amount of freedom to user for configurability and extensibility. It has standard performance for average volume and variety. However there is scope for improvement in terms of giving view of all KPIs of for a business enterprise.</td>
</tr>
<tr>
<td>Level 1</td>
<td>50% &lt;= Score &lt; 74.99%</td>
<td>Experiment Optimistically</td>
<td>Such BI application is at a nascent stage, trying to experiment through different installation / implementations. It is capable of improving its coverage of features and usability through subsequent releases.</td>
</tr>
</tbody>
</table>

*referential or referent-i-able customers – customers that are looking for similar (if not identical) solutions or product in the same business domain.

3. **Significance of various maturity levels**

Significance of the maturity level from customer (or enterprise) perspective are as presented below.

<table>
<thead>
<tr>
<th>Degree or Level of Maturity</th>
<th>What it means for enterprises wanting to deploy a BI system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matured</td>
<td>The BI system would fit easily in to the IT infrastructure portfolio of established large enterprises. Usually the established large enterprises would have their operational procedures almost settled. Hence analysis of the same from various possible aspects to converge on winning combination would be vital. So, given the availability of comprehensive volume of raw data, across all business operations, a matured BI application would be perfect fit for its capability in providing descriptive, predictive and prescriptive analysis. A matured BI application would also give free handles to business users to carry out their own analysis.</td>
</tr>
<tr>
<td>Acceptable</td>
<td>The BI application is Ok to be commissioned in enterprises who are over-indulged in their BAU (business as usual) operations and have relatively lesser focus on analytics. In long run, enterprises have to look for improvement in such BI system. Such improvement can be evolved over time, with minimal investments, so as to cater to forward looking departments within the enterprise.</td>
</tr>
<tr>
<td>Experiment Optimistically</td>
<td>Enterprises toying with idea of hosting an analytical system for the first time, can start with such BI systems and evolve their BI requirement in an iterative mode. Such system is good first draft; helps pave way for defining much more matured requirement of top management, finding areas of refinement in this system. The enterprise gets educated with such BI applications. Most possibly they would eventually settle for a different BI system altogether.</td>
</tr>
</tbody>
</table>

4. **Details of the template**

Various category of questions are:

<table>
<thead>
<tr>
<th>Questionnaire category</th>
<th>Indicative description of areas covered in questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Business vision, alignment to top management thoughts/insight, futuristic requirement aligned to roadmap of the enterprise</td>
</tr>
<tr>
<td>Data Input / Output</td>
<td>Whether the application support processing of data in real-time, near real-time to old.</td>
</tr>
<tr>
<td>Access</td>
<td>User is allowed to access or view data based on authentication, Accessibility of data to 3rd parties with due security check, Comprehensive security set up for each user/role or for that matter any 3rd party consumers</td>
</tr>
<tr>
<td>Application Feature</td>
<td>Adhoc or dynamic reporting analysis by biz users, availability of canned reports/dashboards, allowing statistical computing, allowing data download, alerts features, supporting internationalization, ease of use, loosely coupled software components/modules</td>
</tr>
<tr>
<td>Visualization</td>
<td>Modern, state of art, yet easy to understand, intuitive presentations / charts</td>
</tr>
<tr>
<td>Technology</td>
<td>Latest technology platform, digital, mobility, costing of infrastructure and operations</td>
</tr>
</tbody>
</table>
5. **Formulae to calculate the final % age score in the template:**

Each question is given a weightage. The weightage can be changed considering applicability of questionnaire for the BI application. But it’s recommended not to change.

Lowest: 0, Average: 1, Medium: 2, Highest: 3

Compliance to each question can be recorded with answer such as below:

- Irrelevant: 0
- Consistent: 2
- Compliant: 3
- Conformant: 4
- Fully-conformant: 5
- Non-conformant

Same as weightage of the question

Then compute the following values.

<table>
<thead>
<tr>
<th>Compute the following value</th>
<th>Formulae to compute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual weightage</td>
<td>Weightage as set previously if compliance is not responded as “irrelevant”,</td>
</tr>
<tr>
<td></td>
<td>“0” if compliance is responded as “irrelevant”</td>
</tr>
<tr>
<td>Maximum score</td>
<td>Actual weightage * 5</td>
</tr>
<tr>
<td>Actual score</td>
<td>Actual weightage * Compliance</td>
</tr>
<tr>
<td>For final %age score in each category</td>
<td>Sum of actual scores of each question as a percentage of total maximum score for the corresponding question</td>
</tr>
<tr>
<td>For final %age score of overall Application</td>
<td>Sum of actual scores of each category as a percentage of total maximum score for the corresponding category</td>
</tr>
</tbody>
</table>

Then compare the final score of overall application with the three distinct scales provided in “section 2. Meaning of each level of maturity” and infer on the status/level of the BI application.

6. **Details of the template - List of questions:**

List of questions under various categories, along with their weightage are mentioned below.

<table>
<thead>
<tr>
<th>Category/ Aspect (Weightage)</th>
<th>Principle or description of aspect</th>
<th>Question (or the Need, the expected feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business (3)</td>
<td>Alignment to Business vision</td>
<td>The output of a BI application have formal approval from business leadership. The output includes well defined business KPI (key performance indicator) presentations over various dimensions, Descriptive analysis, Root cause analysis, and what-if analysis - for key business functions</td>
</tr>
<tr>
<td>Business (3)</td>
<td>Business requirement</td>
<td>Business would be able to carry out segmentation of critical entities (e.g. Customers, Employees, Shareholders, items or any other subject) by using the BI application</td>
</tr>
<tr>
<td>Business (2)</td>
<td>Business requirement</td>
<td>Application gives provision to help the business to create new KPIs based on dynamic business need (changing market situations).</td>
</tr>
<tr>
<td>Business (3)</td>
<td>Business requirement</td>
<td>Application gives provision to minutely analyze behavior of an entity (i.e. say any customer/stake holder / subject/ department/ item etc.) at its lowest grain level as well as aggregate level. For example: There is provision to see buying pattern of a set or segment of customers as well as buying pattern of an individual customer in that segment. Such is enabled by seeing first the aggregate report and then allowing the user drill down to individual customer grain level.</td>
</tr>
<tr>
<td>Data Input /Output (3)</td>
<td>How current is the data</td>
<td>Application enables a near real time data (or one day latency data) to end users for decision making.</td>
</tr>
<tr>
<td>Data Input /Output (2)</td>
<td>Response time</td>
<td>Application enables real-time visibility into data that is captured in data warehouse (DWH)</td>
</tr>
<tr>
<td>Data Input /Output (3)</td>
<td>Richness of Analytics</td>
<td>Application leverages statistics, advanced techniques, algorithms, and sophisticated data search capabilities.</td>
</tr>
<tr>
<td>Category/Aspect (Weightage)</td>
<td>Principle or description of aspect</td>
<td>Question (or the Need, the expected feature)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Scalability</td>
<td>Application has been developed using flexible data architecture so that it can adapt to new and changing business needs.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Multi-dimensional analysis</td>
<td>Application uses OLAP structure for Business KPI derivations. Data structure for OLAP are generally achieved by Star schema, Snow flake schema, and other similar types of schemas that have place holders for Facts dimensions as desired by business.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Multi-dimensional analysis</td>
<td>In the OLAP data structure, data marts are defined specific to subject areas as desired by business.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Multi-dimensional analysis</td>
<td>In the OLAP data structure, the fact values are recorded over the standard dimensions such as: a) time dimensions (year, quarter, month, date and even hour if relevant), b) Geography (Country, State, district etc.) Note that the dimensions would depend actual KPI definition as desired by Business.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Digital technology enablement</td>
<td>Application is capable to handle statistical and social media analysis.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Richness of Analytics</td>
<td>Predictive Models capability: Application is capable of advanced analytics facilitating synthesis of models that predict future behavior (Estimating unknown outcomes).</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>Flexibility</td>
<td>Application is capable to access and integrate data from different source systems and different types of source systems as relevant for the business domain.</td>
</tr>
<tr>
<td>Data Input/Output (2)</td>
<td>Effective onboarding of source data</td>
<td>Application utilizes optimized queries for each data sources and appropriately aggregates them efficiently.</td>
</tr>
<tr>
<td>Data Input/Output (2)</td>
<td>How current is the Data</td>
<td>Dashboard and canned reports are always tagged with a date of generation. Also they are auto-refreshed after certain interval of time, which can be configured by user.</td>
</tr>
<tr>
<td>Data Input/Output (3)</td>
<td>How correct is the Data</td>
<td>Data aggregated and presented to the user is accurate and there are means to validate the same. Validation methodology can be slightly technical in nature.</td>
</tr>
<tr>
<td>Data Input/Output (2)</td>
<td>How correct is the Data</td>
<td>There is an acknowledgement / rider / pre-text by the Application architect, by showing due reasons, on the accuracy of financial and non-financial data output. Example statement: The aggregated data as presented to the user for &quot;customer base&quot; is accurate at least by 98%. E.g. maximum 2% error may be there in summations and calculations. The aggregated data as presented to the user for &quot;Un-billed revenue&quot; across the organization is accurate at least by 99.9% e.g. maximum 0.1% error may be there in calculation.</td>
</tr>
<tr>
<td>Access (3)</td>
<td>Data view security</td>
<td>Data can be accessed using different filtering conditions and different dimensions that are specific to user’s authorization. This is required because many a time users are usually tagged to certain level of hierarchy in Business units.</td>
</tr>
<tr>
<td>Access (3)</td>
<td>Data view security</td>
<td>Users can drill down or apply filter in a canned report and dashboard.</td>
</tr>
<tr>
<td>Access (3)</td>
<td>Ease of Consumption</td>
<td>Data services, with validation of due credentials, are available or published that can be consumed by in-house applications / departments for specific requirements. For example: Web services are published to trusted (validated by credentials) consumers (finance department) to consume specific data.</td>
</tr>
<tr>
<td>Access (2)</td>
<td>Ease of Consumption</td>
<td>Data services, with validation of due credentials, are available for 3rd party extraneous (legal etc.) applications / institutions for specific requirements. For example: Web services are published to trusted (validated by credentials) mobile applications to consume specific data.</td>
</tr>
<tr>
<td>Access (3)</td>
<td>Security-Authorization</td>
<td>Business administrator can assign roles to users and specific privileges to roles. There after user can traverse through the application as per assigned privileges.</td>
</tr>
<tr>
<td>Access (2)</td>
<td>Security-Authentication</td>
<td>When implemented in a business enterprise, the BI application can be SSO integrated with minimal changes through industry standard frameworks e.g. Central authentication server, Lightweight directory access protocol, IBM security access manager, Microsoft active directory.</td>
</tr>
<tr>
<td>Category/ Aspect (Weightage)</td>
<td>Principle or description of aspect</td>
<td>Question (or the Need, the expected feature)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------</td>
</tr>
</tbody>
</table>
| Access (2)                  | Security                          | Business administrator can assign purviews to Users. For example:  
  a) Marketing manager for “West coast” shall see all data related to West coast only. West coast is a purview assigned to a specific User having role as “Marketing manager”.  
  b) “Store inspector” is a role that can be assigned to a user. One user having role as “Store inspector” if assigned a purview of “eastern zone” then it allows him to inspect all stores falling in eastern zone only. |
| Application Feature (3)     | User enablement                   | Business users do not need to understand physical data models and they can create adhoc report for analysis with an utility that allows user to drag and drop the columns, define filter criteria and generate the report at a time of user’s choice. |
| Application Feature (3)     | Provisions for statistical computing | Product provides the facility of effective data mining, to support data analytics - descriptive, predictive and prescriptive. |
| Application Feature (3)     | Provisions for statistical computing | Users can create new analytical reports from scratch or modify existing analytic reports in the application. |
| Application Feature (3)     | Best practice in market           | Application provides the facility of custom dashboard creation where number of business matrices (KPI reports-canned) can be presented in a single consolidated view. |
| Application Feature (3)     | Best practice in market           | Application provides the facility of custom dashboard creation where number of business matrices (user defined reports through adhoc reporting feature) can be presented in a single consolidated view. |
| Application Feature (3)     | Business requirement              | Application provides the facility running of one or more reports at certain sequence and at certain specified time (as per user’s requirement). |
| Application Feature (3)     | Business requirement              | Application has provision to configure SCD (slowly changing dimension) fields of at least type 1, type 2 and type 3. (Though generally DWH apps go up to type 7.  
  SCD type 1: Say “status of an account” is usually just one and unique - that is “Active”. If at some point in time the biz decides to make the value as “Open” then we have update the status of all the accumulated accounts in DWH till now, to “Open”.  
  SCD type 2: there shall be one more column reading “current status” which will hold just the most recent value of status  
  SCD type 3: We should have provision to keep history of status value changes along with time of change, in a chronological manner. |
| Application Feature (2)     | Personalization feature           | There is provision to add a logo to the screens, dashboard, the reports (canned and adhoc). |
| Application Feature (3)     | Intuitiveness in presentation layer | Features of downloading data and graphs to following format is available: MS excel, MS word, CSV format, XML format, PDF |
| Application Feature (3)     | Integration with other Systems    | Application provides the facility of Jumpstart integration with other application (Ex- CRM, ERP, general bespoke Web systems). |
| Application Feature (3)     | Automated prompting to Users      | Application support for Alert functionality to allow user to be alerted when biz parameter crosses a threshold value. |
| Application Feature (3)     | Communication                    | a) Email functionality is available and the recipients of an email are configurable by Business administrator.  
  b) Print functionality is available. |
<p>| Application Feature (2)     | Ease of Use                      | User is given wild card search provision in most used functions of the application e.g. Searching a canned report, Searching one single customer, Searching value for a filter criteria that has lot of values Or any other entity search that the biz may want to have. |
| Application Feature (3)     | Internationalization             | There is configurable feature to allow the Application set up for specific geography (US, UK, Middle-East, Europe etc.) |
| Application Feature (2)     | Less-coupling interfaces         | Interfaces as per architecture should be loosely coupled. |
| Visualization (3)           | Ease of understanding from visuals | If the data has a spatial attribute like region, branch, state, location, etc..., it can be visualized on a spatial visualization known as a Map View. |</p>
<table>
<thead>
<tr>
<th>Category/ Aspect (Weightage)</th>
<th>Principle or description of aspect</th>
<th>Question (or the Need, the expected feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualization (3)</td>
<td>Intuitiveness in presentation layer</td>
<td>Data visualization capabilities- Application is utilizing graphics, charts, grids, gauges, and maps and provides the framework where different type of charts can be generated.</td>
</tr>
<tr>
<td>Visualization (3)</td>
<td>Availability of Default settings or features</td>
<td>Application provides default features in terms of a standard dashboard, standard canned reports, default options chosen in filtering parameters</td>
</tr>
<tr>
<td>Visualization (3)</td>
<td>Intuitiveness in presentation layer</td>
<td>The charts are supplemented with tool tips for various data points</td>
</tr>
<tr>
<td>Visualization (2)</td>
<td>Intuitiveness in presentation layer</td>
<td>The tool tip also is capable of showing small trend charts.</td>
</tr>
</tbody>
</table>
| Visualization (3)           | Ease of understanding from visuals | Visualization is carefully crafted and is configurable* by business administrator to help easy reading and understanding by the intended user base with specific attributes e.g. Old age users, semi-blind users, color blind users, skill set or IT awareness of users etc.  
*Example of ease of configuring: The legends, labels should be able to be visualized in vertical, horizontal or slanted manner as a user may want. |
| Technology (2)              | Digital technology enablement | Application already uses Big data platform to handle Big data in terms of variety: structured as well as unstructured data |
| Technology (3)              | Digital technology enablement | Application already uses Big data platform to handle Big data in terms of volume and velocity - e.g. transactional data, sensor data, social media data, and weather data etc. as the current biz case demands. |
| Technology (3)              | Digital technology enablement | Application has a road map in terms of upgradation/Extension of Big data platform and comprehensive analytics scope. |
| Technology (3)              | Digital technology enablement | Application’s Big data platform is certified by industry standards for Big data application e.g. Cloudera certified. |
| Technology (2)              | Digital technology enablement | End user visualizations have responsive UI feature (adjust to display device according to available real estate in the device) |
| Technology (2)              | Digital technology enablement | The application - especially the modules that are accessed by eventual end user - is accessible in a legible manner from a Smart-phone/tab. Such is feasible if the client piece of the application can be made a Mobile application (for iOS, Android, Windows) or application is accessible with sufficient legibility as a normal internet application. |
| Technology (2)              | Cost of development and over all pricing | Application is developed in Open source software technology (e.g. Postgresql, MySQL, Hbase, Hive, D3) as opposed to commercially available technology (from Microsoft, IBM, Oracle etc.) |
| Deployment & Upgrade (3)    | Ease of (un) deployment | Installer is available with support for installation as well as uninstallation. |
| Deployment & Upgrade (3)    | Deployment architecture & hardware | Deployment architecture is available and proven in a typical client IT echo system |
| Deployment & Upgrade (3)    | Componentization | Application package can be decomposed into independent modules and installation can be done for specific components as relevant for a customer |
| Deployment & Upgrade (2)    | Product upgrade to new version or Patches | a) A defined proven migration strategy (both application & Data) is available and the same is documented in step-by-step manner so as to ensure a smooth upgrade of the Application to its newer versions or patches.  
b) The migration strategy clearly articulates which all previous versions of the application can be upgraded.  
c) The migration strategy also articulates how to migrate the existing data that is already contained in the current instance of Client implementation. |
| Deployment & Upgrade (3)    | Deployment architecture & hardware | Deployment architecture specifies optimized specification of hardware w.r.t. which the application has been benchmarked for performance?  
Volumetric computation template for the specified business domain is available and can be used before each implementation.  
Such a template, when fed with appropriate biz volume, shall return what storage sizing we should have. |
<p>| Deployment &amp; Upgrade (3)    | Deployment architecture &amp; software | Deployment architecture clearly articulates server side software and their version based on which the application has been benchmarked. |</p>
<table>
<thead>
<tr>
<th>Category/Aspect (Weightage)</th>
<th>Principle or description of aspect</th>
<th>Question (or the Need, the expected feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment &amp; Upgrade (3)</td>
<td>Interoperability</td>
<td>Application doesn’t require special client side implementation. Each user’s device should not have to install any custom made software (except for a mobile App) in order to be enabled to access the Application. Just a standard free-to-use browser should be all that a client device needs. There should not be any further additional software installation/Configuration of the client device.</td>
</tr>
<tr>
<td>Deployment &amp; Upgrade (2)</td>
<td>Enabling Sales, Presales</td>
<td>There is standard easy to use Demo script, yet with impressive system output, available that can be used by Sales team for showcasing the application to potential customers.</td>
</tr>
<tr>
<td>License model and terms (2)</td>
<td>Componentization or Modularization</td>
<td>Licensing terms gives provision to sell one or more components from the application package.</td>
</tr>
<tr>
<td>License model and terms (2)</td>
<td>Costing in case of Upgrade</td>
<td>Licensing terms articulates terms and conditions for upgrade to new version, patches in terms of what is chargeable (and what is not chargeable) to the customer. Note - The upgrade may require huge service engagement if the instance of the client implementation has gone through too much customization (as opposed to client using the original version of the Application).</td>
</tr>
<tr>
<td>License model and terms (3)</td>
<td>Costing in case of maintenance</td>
<td>Licensing terms includes clear provisions for AMC (annual maintenance contract)</td>
</tr>
<tr>
<td>License model and terms (3)</td>
<td>Partnership</td>
<td>Technology partner if any are part of a formal support agreement.</td>
</tr>
<tr>
<td>Documentation (3)</td>
<td>Master data maintenance</td>
<td>Handling of static data (master data) are clearly articulated in ETL administration and/or Installation manual.</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Documentation</td>
<td>Input files - as desired by the application - has sufficient business articulation for the input entities/attributes i.e. mandatory entities/attributes, field attributes (data type, length), sample example values for each field, Cardinality of each entity, inter file/entity relationship etc. Input file layout is supplemented with a logical/Physical data design document.</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Self-help documents</td>
<td>ETL SOP - standard operating procedure for the batch jobs that extract transform load - is available along with trouble shooting tips (FAQ).</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Self-help documents</td>
<td>System administration document along with a FAQ is available</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Self-help documents</td>
<td>Installation manual + FAQ document are available to be used for initial set up.</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Self-help documents</td>
<td>User manual is available with screen shots - as an on-line as well as off-line feature</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Self-help documents</td>
<td>Performance bench marking documentation in terms of a) capability to handle certain volume of data in specific windows of time, b) response time of various report generation features with specific user base and specific underlying data volume</td>
</tr>
<tr>
<td>Documentation (2)</td>
<td>Architectural literature</td>
<td>All architecture documents - Business, Application, Data, technology, and Deployment - are available.</td>
</tr>
<tr>
<td>Documentation (3)</td>
<td>Self-help content</td>
<td>Every error coming out of system has code, short description, long description and potential proposal/means to resolve the same.</td>
</tr>
</tbody>
</table>

**About the Authors**

**Mr. Manish Kumar** [CSI: I1503326] is currently working as associate consultant in Tata consultancy services ltd., Bhubaneswar. He is an expert in BI systems design/development in different industry domains. His primary interest are data structure design and reporting from online analytical processing data warehouse systems, volumetric computation and performance modelling. He can be reached at m.kumar@tcs.com.

**Mr. Ranjan Sarangi** [CSI: I1501560] is currently working as senior consultant in Tata consultancy services ltd., Bhubaneswar. He leads a set of business product development initiative in digital technology platform and in the domain of customer intelligence and insight in banking/retail/telecom. His primary interest are data management, deriving insight from data and ensuring output of IT (BI) systems is for best business consumption. He can be reached at ranjan.sarangi@tcs.com.
Introduction

There has been considerable debate in the country about the privacy of the Aadhaar database. UIDAI has officially taken the position that the personal data held by it is private and cannot be shared with others. Consequently, every government agency and private enterprise seeks and stores personal information in their databases. Whenever personal information, such as address, changes, many entities continue to hold old incorrect information.

Data Sharing after Authorization

This article proposes a method to address the problem of inconsistent data while maintaining the privacy of personal information. The data items in the Aadhaar database will be divided in two groups. The first group will contain data items such as address that can be shared with entities if authorized by the person whose data it is. The second group will contain data items, such as bank details, that are not to be shared. The method of sharing the data items in the first group is discussed below. This method is called a Subscription process. The subscribers are divided in three groups: government agencies, service providers and private persons.

Subscription by a Service Provider

A person goes to a bank to open an account. He provides his Aadhaar number (and where additional authentication is required, puts his thumb on the finger print reader). The service provider contacts the Aadhaar server online making a subscription request. Aadhaar server sends the subscription request to the person's registered mobile number. The person replies to this SMS confirming or denying subscription.

If subscription is confirmed, personal details are sent to the service provider, and subscriber's details recorded in the Aadhaar database against the person’s Aadhaar number.

There can also be an option of one-time subscription, in which case data will be provided but will not be updated in future.

Subscription by another Person

A person’s address and other contact details are also of interest to his family, friends etc. They also need to be updated if any change takes place. This is also managed using the subscription model. Subscription by another person works in the same way as it does for a service provider, except that the subscription request is sent using an SMS or an e-mail and contact details are also received by the same means of communication.

Subscription by another person can include a message from the subscriber to the person (via Aadhaar server) to facilitate identification of the subscriber and the purpose of subscription.

Subscription by another person can include a ‘Reciprocal flag’. If this reciprocal flag is selected, on approval of subscription request, both persons will become subscribers to each other.

Subscription by Government Agencies

Subscription by government agencies will be based on legislative approval (bill passed by Parliament or State Legislature) and will not require approval of the person concerned.

Change of Personal Data

When a person’s personal details, e.g. his address, changes, he will update it in the Aadhaar database. Aadhaar database will send these changes to all the subscribers in appropriate format (e.g. SMS and e-mail to subscribing persons) who will update their respective database. The fact that the change in Aadhaar database will change a person’s personal information in all databases will encourage a person to keep his Aadhaar database current.

Monitoring Subscribers

A person can view the list of his subscribers in the Aadhaar database.

Unsubsccribing Subscribers

A person can ask the Aadhaar database to unsubscribe one or more subscribers. The Aadhaar database will communicate this to the concerned subscribers and delete their subscription.

Conclusion

The method proposed in this article ensures consistency of personal data held by multiple entities and reduces the effort of providing data to a new entity, while maintaining the privacy of a person’s personal data.

Errata

CSIC Dec. 2015, Page 20 Last paragraph: Please read Fig. 2 and Fig. 2(d) in place of Fig. 3 and Fig. 3(d).
Introduction

We are living in the world of WEBs. Think about anything right from basic needs like grocery shopping to financial transactions to education, virtually, everything is moving on the Web. Why – the answer is straightforward. Web service is accessible to everyone from anywhere and this, in turn, makes our life easy. When deploying a Web service, by and large, there are two important factors that are considered –

• How can we offer the service to the customers?
• How securely can we offer the services to the customers?

The discussion in this article will revolve mainly around point no. 2 where we’ll talk about one of the significant initiatives by The Internet Security Research Group (ISRG) - Let’s Encrypt.

Background

Before we dig deeper into Let’s Encrypt, let’s understand why we need TLS at the first place – To encrypt sensitive information that is being transmitted over the network so that only intended recipient can decrypt/understand it. Let’s Encrypt, as the name depicts, is a free, automated and an Open Certificate Authority, who aims to enable the TLS on the entire Web. And one of the possible ways to achieve this is by using Digital Certificates. The digital certificates are one of the critical elements in the infrastructure, and it is necessary to establish a secure connection between the two communicating parties. At present, there are many Public CAs who issue the TLS certificates, however it comes with a cost. This group offers the free TLS certificates to anyone who can prove the possession of the given domain name. The interesting element in this project is that the group offers an open source tool that automates the certificate issuance as well as renewal.

Architecture Analysis

So far, the project has reached few important milestones, one being The ISRG Root certificate is trusted by majority of web browsers. Let’s Encrypt has issued over 26,000 certificates during the Limited Beta Phase. As of this writing, the project is in Public Beta stage. Let’s have a look at some important design aspects –

• The scope of project is limited to TLS certificates only.
• The group has approved Certificate Policy (CP) and Certificate Practise Statement (CPS).
• Let’s Encrypt is a 3-tier PKI architecture including one Root CA, two Subordinate CAs and one Policy Management Authority.
• Root CA Certificate are self-signed and contains 4096-bit RSA with SHA256 having a validity of 20 years.
• Subordinate CA (Let’s Encrypt Intermediate X1 and Let’s Encrypt Intermediate X2) Certificates contain 2048-bit RSA Keys with SHA256 and has a validity of 5 years.
• ISRG Root CA signs the Subordinate CA certificate. The Subordinate CA will issue the certificates to the end users.
• The purpose of the PMA is to establish, monitor, and maintain the integrity of Certificate policy and associated public key infrastructures (PKIs).

• The private keys for the ISRG Root CA and the Subordinate CAs are stored on FIPS 140-2 Level 3 hardware security modules (HSMs).
• As of this writing, the end point (client) certificates are issued with the validity of 90 days, though the team has plans to further reduce the certificate lifetime.
• Root CA CRLs are issued every thirty days.
• No CRLs are issued for Subordinate CAs. Instead Certificate status is available through OCSP validation.
• One interesting aspect in this project is that the group intends to publish not only the revoked certificates list but also to publish the list of all issued certificates in a central repository. In this way, any rouge certificate can be identified who pretends to be signed by Let’s Encrypt.
• The project has a robust DR plan as mentioned in their CPS. For normal circumstances, one Subordinate CA (Let’s Encrypt Intermediate X1) will issue the certificates to the end users. The other Subordinate CA (Let’s Encrypt Intermediate X2), is allied with the disaster recovery site and will only be used when the capacity of “Let’s Encrypt Intermediate X1” is lost/impacted.
• As per the policy document, ISRG maintains a minimum of 99% availability per year, and planned down-time will not exceed 0.5% annually, excluding network outages.

Technical Analysis

Let’s Encrypt is based on server-client architecture where a web server (client) can obtain the certificate from the Let’s Encrypt Intermediate CA (Server) without any manual intervention. The team has developed a new protocol - The Automated Certificate Management Environment (ACME). This protocol allows the CAs to automatically verify if the applicant actually controls the domain (for which the certificate is requested) and also to facilitate automatic certificate issuance and management.

On the client (web server) side, the certificate issuance and management is accomplished by a certificate management agent. The agent performs two main activities –

• To proves to the CA that the web server who is requesting for the certificate actually controls the domain.
• Requesting, renewing and revocation of the certificates for that domain.

Step 1: Domain Validation

The first time, the agent installed on web server, interacts with Let’s Encrypt CA, it generates a new key pair. In order to obtain a valid certificate, the agent needs to prove the possession of the domain(s) to the Let’s Encrypt CA. The CA issues one or more set of challenges to the agent. Along with the challenges, the CA also provides a nonce that must be signed by the agent’s private key pair so as to prove that it controls the key pair. Therefore, the agent needs to satisfy both the needs – response to the challenge(s) given by the CA and signs the nonce with
its private key. It then notifies the CA to verify and complete the validation. Once the signature over the nonce is validated, and the challenges are verified by the CA, the agent (identified by the public key) is authorized to do certificate management for the given domain.

Step 2: Certificate Management - Issuance and Revocation

Post Domain Validation, the agent generates a Certificate Signing Request (PKCS#10) for the certificate. This CSR contains two signatures - One - by the private key corresponding to the public key of the web server. Two - The agent signs the entire CSR with the authorized key pair in step 1, so that the CA understands that the request is coming from an authorized agent.

Both the signatures are verified by the Let’s Encrypt CA. If successful, it issues a certificate for the given domain and returns it to the agent.

When the issued certificate needs to be revoked, the agent signs a revocation request with the authorized key pair for the given domain. The CA verifies the request and publishes revocation information into the revocation channels (i.e., CRLs, OCSP).

Our Viewpoint

Security advocates have always emphasised to enable HTTPS protection on the websites and the benefits are obvious. Enabling HTTPS remediate one of the prevalent Man-In-The-Middle (MITM) attacks and also prevents the attackers to sniffer or divert the traffic or insert malware into it. Let’s Encrypt aims to enable HTTPS as seamless activity across the web at no-cost.

The Big Giants like Mozilla, Electronic Frontier Foundation, Cisco Systems, IdenTrust, Akamai Technologies along with the researchers of University of Michigan came together and worked with Internet Security Research Group (ISRG) to build Let’s Encrypt. The team also has plans to standardize the ACME protocol in the IETF.

Overall, the project looks promising. We understand that project will be well-thought of from different dimensions, however, there are few aspects to ponder upon - When a malicious server pretends to be the genuine server to obtain the certificate (identity spoofing and MITM), is the Domain Validation process robust enough to delineate the genuine request vs. malicious request? Currently, Extended Validation (EV) is not in the project scope, so, how can the ‘proven’ trust be established. The lifetime of issued certificates is 90 days, which may bring operational overhead, particularly when the certificates need to be configured manually. As of this writing, the project is in Public Beta stage. Despite of all the challenges, we believe that Let’s Encrypt will bring a much needed revolution on the internet and is likely to increase the security bars significantly.

Disclaimer

All the logos, product names and trademarks are owned by the respective owners and the authors have no intention to use them in anybody’s favour. Without any prejudice, the authors presented their views and understanding of various technologies. The views presented in this paper are authors’ personal and need not represent the opinion of their parent organization.

References


About the Authors

Ms. Richa Garg works for a Fortune 500 organization as a Senior Associate. She has 8+ years of experience in Information Security domain. She is also a certificated CISSP, SSCP Professional. Her primary interests include PKI, Key Management, DRM and Strong Authentication and Cryptography.

Mr. Satish Kumar Selvaraj works for Fortune 100 organization as a Senior Security Analyst. He has 5+ years of experience in Information Security domain. Currently, he is pursuing his MBA in Information Security. He specializes in network security and is also a certified Network and security professional.

Life Time Achievement Awards

1. Dr. Ratan Dutta
2. Dr. S Ramani
3. Dr. K. K. Aggarwal
4. Dr. P. Trimurthy
5. Sri S. Mahalingam
6. Prof. S. V. Raghavan

Hon. Fellows

1. Sri J. S. Deepak

Fellows

1. Sri S. Pathasarathy
2. Prof. D. K. Meena
3. Sri Sanjeev Kumar
4. Dr. Gautam Mohapatra

Award for Special Contribution in E-Governance

2. Prof. A. K. Nayak
3. Prof. Hari Mohan Gupta
4. Dr. D. Janakiram
5. Prof. A. K. Nayak
6. Prof. Hari Mohan Gupta
7. Dr. D. Janakiram

Crossword »

Test your knowledge on Open Source Software
Solution to the crossword with name of first all correct solution provider(s) will appear in the next issue. Send your answer to CSI Communications at email address csic@csi-india.org and cc to drdurgeshmishra@gmail.com with subject: Crossword Solution – CSIC January Issue.

CLUES

ACROSS

5. A project acronym for open source software
7. A repository of thousands of open source projects
8. A Linux-based Open source platform for mobile
9. A virtual learning system
10. A tool for automated website hosting
12. Quality control expert of an open source software community
13. An open source mail transfer agent

DOWN

1. An integrated development environment
2. An open source distributed database system
3. A 3D graphics and animation package
4. To give a limited version free and charge for premium version
6. An error or flaw in computer program
8. A Freely-available web server
11. Developing a new program from some open source code

Hour of Code

Hour of Code is a global movement to show the people that programming is a fun and can be learnt by any age group students and with any background just by devoting “One Hour”. The program is organised by a non-profit organisation code.org in 180+ countries. The supporting tutorials are available in 40 languages to teach programming basics to students of age from 6 to 104 years. About 200 million students participated in the program till now. The program is supported by Microsoft, Apple, Amazon, and many other organisations. Tutorials are available which teach very interesting programming ideas like; how to build your galaxy in Star Wars, Game building tutorial etc.

Rashid Sheikh
Associate Professor, Sri Aurobindo Institute of Technology Indore

Solution to December 2015 Crossword

We are overwhelmed by the response and solutions received from our enthusiastic readers

Congratulations!

All Correct Answers to December 2015 month’s crossword received from the following readers:

UmamaheS Pemmaraju Senior Manager-Compliance, Value Momentum Software Services Pvt. Ltd. Hyderabad
R.Venitta Raj Assistant Professor (Sr .G), IT Department, Mepco Schlenk Engineering. College, Sivaksi.
Vijayalaxmi R Patil Assistant Professor, Department of ISE, Dr AIT, Bangalore
Prof. K.K. Aggarwal, Chancellor, K R Mangalam University, Delhi- NCR also serves as Member, Board of Governors, MITS, Gwalior. He has completed his tenure as Member, Board of Governors, IIT, Patna and as Chairman, Board of Governors, MNIT, Jaipur. Prof. Aggarwal is the Chairman, Engineering Evaluation & Accreditation Committee for all Engineering programs being conducted in Affiliated Colleges, all over the Country.

Prof. Aggarwal obtained his Engineering Degree from Punjab University and Masters degree from Kurukshetra University securing First position in both. Later, he did his Ph.D in Reliability Evaluation and Optimization also from Kurukshetra University. In 1975, he rose to the level of Professor at an age of 27½ years, probably the youngest person in the world to have achieved this level. After a distinguished service of 27 years at NIT, Kurukshetra, Prof. Aggarwal was appointed Pro Vice-Chancellor, Guru Jambheshwar University (Technical University of Haryana), Hisar for a period of three years, and then in 1998 appointed as Founder Vice Chancellor of GGS Indraprastha University, Delhi. He continued on this position upto November, 2008.

He has been President of the Institution of Electronics and Telecommunication Engineers (IETE) for the period 2002-2004. During this period, this Institution witnessed an unprecedented growth and made a remarkable impact on the society in general & IT professionals in particular. He also served as Sectional President (IT & CS Section) in the Indian Science Congress Association, President, Computer Society of India for the period 2007-2009 and President of South East Asia Regional Computer Confederation (SEARCC) for the years 2008-10.

Prof. Aggarwal has extensively worked in various fields of Electronics and Computer Engineering. Has published about 350 papers in the reputed journals - more than 150 of these in international journals. He has been invited to deliver lectures in several Universities in India and abroad, such as University of Berkley, USA; University of Cincinnati, USA; Florida State University, USA; University of Birmingham, UK; Technical University of Germany, etc.

Prof. Aggarwal did not confine his contribution to the academic field alone and instead made a very strong impact in the industrial world. He delivered lectures in several industrial organisations and conducted programmes for many important industrial houses such as Tata Consultancy Services, BHEL, TVS Electronics, DCM Data Systems, Central Mechanical Engineering Research Institute, Electronics Corporation of India, BEL, ISRO, Defence Research Labs., etc. He has been widely consulted by the industry, most-notable being his contribution towards the Reliability Analysis for PSLV (Polar Satellite Launch Vehicle). He delivered a talk on Reliable Automotive Electronics in Ford Motors, Detroit, USA and also conducted a full day program for Information Management Resources, Florida, USA.

Prof. Aggarwal has written few books and many of his articles have appeared in several books published by IEEE of USA. A couple of years ago, he authored a book on Reliability Engineering which is published by Kluwer Academic, Netherland/USA/ UK. His latest book on Software Engineering published in 2001 has already seen several reprints.

Prof. Aggarwal was honoured by the Reliability Society of IEEE, USA for his services as Guest Editor for the special issue on “State of Reliability Effort of the Indian Sub-Continent”. He was declared as the Man of Decade, Man of the Century and finally Man of the Millennium by American Bibliographical Institute, USA. He was also awarded Delhi Ratan by the All India Conference of Intellectuals. International Biographical Centre, England has published his biography in “The First Five Hundred – at the new millennium” in July 2000. The Broadcast Engineering Society of India honoured him by conferring Honorary Fellowship on him in February, 2001 and the Computer Society of India Conferred the Fellowship on him in 1998 and then in 1998 appointed as Founder Vice Chancellor of GGS Indraprastha University, Delhi. He continued on this position upto November, 2008.

Hisar for a period of three years, and then in 1998 appointed as Founder Vice Chancellor of GGS Indraprastha University, Delhi. He continued on this position upto November, 2008. He has been President of the Institution of Electronics and Telecommunication Engineers (IETE) for the period 2002-2004. During this period, this Institution witnessed an unprecedented growth and made a remarkable impact on the society in general & IT professionals in particular. He also served as Sectional President (IT & CS Section) in the Indian Science Congress Association, President, Computer Society of India for the period 2007-2009 and President of South East Asia Regional Computer Confederation (SEARCC) for the years 2008-10.

Prof. Aggarwal has extensively worked in various fields of Electronics and Computer Engineering. Has published about 350 papers in the reputed journals - more than 150 of these in international journals. He has been invited to deliver lectures in several Universities in India and abroad, such as University of Berkley, USA; University of Cincinnati, USA; Florida State University, USA; University of Birmingham, UK; Technical University of Germany, etc.

Prof. Aggarwal did not confine his contribution to the academic field alone and instead made a very strong impact in the industrial world. He delivered lectures in several industrial organisations and conducted programmes for many important industrial houses such as Tata Consultancy Services, BHEL, TVS Electronics, DCM Data Systems, Central Mechanical Engineering Research Institute, Electronics Corporation of India, BEL, ISRO, Defence Research Labs., etc. He has been widely consulted by the industry, most-notable being his contribution towards the Reliability Analysis for PSLV (Polar Satellite Launch Vehicle). He delivered a talk on Reliable Automotive Electronics in Ford Motors, Detroit, USA and also conducted a full day program for Information Management Resources, Florida, USA.

Prof. Aggarwal has written few books and many of his articles have appeared in several books published by IEEE of USA. A couple of years ago, he authored a book on Reliability Engineering which is published by Kluwer Academic, Netherland/USA/ UK. His latest book on Software Engineering published in 2001 has already seen several reprints.

Prof. Aggarwal was honoured by the Reliability Society of IEEE, USA for his services as Guest Editor for the special issue on “State of Reliability Effort of the Indian Sub-Continent”. He was declared as the Man of Decade, Man of the Century and finally Man of the Millennium by American Bibliographical Institute, USA. He was also awarded Delhi Ratan by the All India Conference of Intellectuals. International Biographical Centre, England has published his biography in “The First Five Hundred – at the new millennium” in July 2000. The Broadcast Engineering Society of India honoured him by conferring Honorary Fellowship on him in February, 2001 and the Computer Society of India Conferred the Fellowship on him in 1998. Prof. Aggarwal was conferred Distinguished Fellowship in 2010 and the very First Life Time Achievement Award in 2011 by the Institute of Electronics and Tele-Communication Engineers, India.

Dr. Rattan K. Datta had his M.Sc.(Hons School) degree in Physics from “Punjab University” in First class and Ph.D from IIT-Delhi on “Monsoon Dynamics & Atmospheric Modeling”. He also underwent advanced training in modeling & computing in India & later in USA & Japan under a UN fellowship program. Dr. Datta has carried out intensive research in the emerging disciplines & has published over 100 research papers in National & International Journals. He has written two books & edited another three books. He has been invited by various national & international institutes to deliver expert lectures besides presenting research papers. He delivered lectures such as Dr. Venketaraman memorial lecture to Indian Mathematical Society (North), Platinum Jubilee lecture at Indian Science Congress (ISCA). Expert lectures at workshops in Beijing, Bangkok, Singapore, Philippines, Florida State University USA etc. Special lectures were also delivered at Vatican Academy, ICTP, Trieste & European Centre for Medium Range Weather Forecasting, Reading UK. Was a regular visiting faculty at University of Miami. He was selected as UNDP Expert in East Africa as ‘data processing expert & Meteorological advisor’(1976-78). He was a Chief Scientist of G.O.I during international Monsoon Experiment (Monex-79), Director International Monsoon data Management Centre 1984-87, Advisor & founder head ‘National Centre for Medium Range Weather Forecasting of Deptt. of Science & technology, G.O.I.’ The centre had the first supercomputer Cray X-MP dedicated for Research on monsoon modeling & established a few education institutes in the country.

Dr. Datta is fellow of Computer Society Of India, IETE, India Met Society, Telematic forum & a life member of Indian Science Congress (ISCA), International Biographical Centre.
National president of computer society of India (CSI), President Indian Meteorological Society, President ICT section of Indian Science Congress (ISCA), & President of Gwalior Academy of Mathematical Sciences (GAMS).

Dr. Datta has been an active member of the executive council of SEARCC in 1990s. He was also the part of organization of first SEARCC conference held at New Delhi in 1988. He is currently Vice-Chairman of TC5 of IFIP (International federation of information processing) a technical body of UNESCO. He served & is serving on various national and international advisory committees on Earth systems and ‘IT’. He is also on the advisory committees of universities and colleges of excellence.

Dr. Datta has taught a number of courses to the students of B.Tech, M.C.A & M.Tech of various universities as an adjunct professor. He has supervised number of M.Tech students and over dozen M.Phil students. Five of his students have received their Ph.D from IIT, BIT’s Pilani and three others from PTU. Adjunct professor in computer science & engineering at Delhi University, GGS Indraprastha University and SBBS Institute of engineering & technology. Chairman of two Technical advisory committee of DST, Govt. of India on planet earth. He was Secretory (academic) SBBS Educational Complex (Currently- Sant Baba Bagh Singh University).

Dr. Datta is currently the Honorary C.E.O & Director, MERIT, an IT educational institute at Delhi. Also an honorary President Multi-Disciplinary Research Group in Bhopal.

Dr. Datta was awarded a gold medal for research by G.O.I in 1975. The International Biographical Centre, Cambridge, UK, nominated Dr. Datta as the International man for the 1992-93. On 9th December 2008, the 20th Anniversary of NCMRWF, Dr. Datta was felicitated by Ministry of Earth Sciences Govt. of India for his Outstanding Research. Dr. Datta was awarded the “Sidha Sewa Puraskar” as eminent Scientist on behalf of Swami Hardas Foundation on the occasion of Glorious World Day. Dr. Datta was felicitated for his “Exceptional Contributions and leadership in promoting Computer Technology and Education in India” by Lingaya’s University on 1st December 2010 during the International Conference on Reliability Infocom Technology and Optimization (ICRITO’ 2010). Dr. Datta has been conferred with the “Mohyal Gaurav” award by the General Mohyal Sabha, the Apex Body of the Mohyal Community in January 2012 & he is also the trustee of Mohyal foundation. On the Feb, 2014, on the Silver Jubilee of NCMRWF, the Ministry of Earth Sciences honoured Dr Datta for his outstanding contribution in the development of the centre. Dr. Datta was honoured with the Golden Jubilee award of CSI.

Prof. P. Thrimurthy

Prof. Thrimurthy, born in a peasant family to Seshamma & Nagaiah, obtained his B.Sc from Andhra University during 1971. He got his M.Sc (1973) and Ph.D in Mathematics (1977) from Gujarat University.

He served Armed Forces Head Quarters (AFHQ) in Delhi, Gujarat University, Sardar Patel University and Acharya Nagarjuna University and retired as Professor of Computer Science during 2009. He had served in various positions at these Universities, which include Professor, HoD of Computer Science, Director of University Computer Centre and Chairman Board of Studies in Computer Science.

At Sardar Patel University, he had contributed in bringing up the University Computer Centre, computerising all the MIS activities during 1981-82. He had established the Dept. of Computer Science by initiating several certificate programs for professionals, Teachers’ Training Programs, Graduate programs, Master level Programs (including MCA) and Ph.D. Programs in Computer Science. The first Seven Ph.D. holders of Computer Science in Gujarat State, happened to be his Students. He was honoured as “Father of Computer Education” in that Region by Sardar Patel University.

At Acharya Nagarjuna University, Prof. Thrimurthy has lead the teams for developing projects for the entire University as Chairman of IXth, Xth and XIth Plan ANU-UGC Committees. He has been the Executive Council Member of Acharya Nagarjuna University for over Eight years and contributed in infrastructure Development. As University Coordinator of Student Knowledge Forum, Prof. Thrimurthy had introduced “Skills Development” programs that improved employability of students in the University and ANU affiliated colleges. As the Chief Advisor of ANU College of Engineering, he has been the pioneer in starting the College of Engineering and College of Architecture in the campus of Acharya Nagarjuna University. For the United Andhra Pradesh, his team created BCA and MS (IS) programs and Prof. Thrimurthy had coordinated several faculty development Programs.

Prof. Thrimurthy become the Life member of CSI during 1979 and adopted CSI as his family. He had formed the Vallab Vidyagazar Chapter and initiated several programs for the society at large. Looking at his services, Mr. Hemant Sonawala picked him for the Student activities in the country. Prof. Thrimurthy had served CSI for over 30 years in different roles. They include, as National Student Coordinator, Chairman of Education, software, Rural Applications Divisions, CSI publications and finally as the President of CSI during 2009-'10. He has become a source of inspiration to many in CSI. Several Student branches/ Chapters had been formed in the country through his initiatives. CSI membership increased. It is worth to mention that CSI has established corporate office premises in Mumbai during his tenure as President. He is a Fellow of CSI.

He has been the Indian representative of CSI in SEARCC for International meets in 8 countries, Member of SRIG-ET (SEARCC Regional

CSI Communications | January 2016 | 41
Prof. S. V. Raghavan is the Chief Architect of India’s National Knowledge Network (NKN) and Chair the Technical Advisory Committee of NKN. He has been integral to facilitating our Hon. President’s biannual address to all Vice-Chancellors and National Institutes of Technology across the country. Professor Raghavan is the Grand Master of the NKN - his keen insight is instrumental in delivering NKN as one of the World’s largest Research and Education Networks (RENs). NKN is already present in New York, Amsterdam, and Singapore, in addition to strong impressions created at CERN Geneva and TEIN (Trans-Eurasian Information Network). He is the trusted advisor & counsel to NKN (Deity, MCIT), NMEICT (MHRD), and NOFN (DoT, MCIT) to position the projects with our Government’s Digital India program.

Combining scientific research and innovation, Prof. Raghavan has devised an Infrared Imaging System based on non-invasive method for Breast Cancer screening and transferred the technology to industry. He was the IFIP invited keynote speaker at the World Computer Conference 2010 in Brisbane, Australia. He is the founder member of ERNET (contemporary of DARPA, United States).

Prof. Raghavan launched a multi-institutional project on Smart and Secure Environment (SSE) and authored the Distributed Denial of Service Attack on Critical Infrastructure, published internationally by Springer. It is notable that Hon. Julia Gillard, former Prime Minister of Australia, visited him during this period in appreciation of his contributions. As an expert member, he guided the National Task force on Technology for Payment Systems and the Monetary Policy of 2000, setup by Reserve Bank of India. At IIT Madras, he was the Chairman of Integrated Computing Environment (ICE), Department Chair, and Director of Network Systems Laboratory (NSL) for three decades. He established the office of Dean (Planning) in IIT Madras and served as the Founder - Dean. He established a fully automated State-of-the-art Data Centre and a Campus Network. Under his stewardship, NSL pioneered the indigenous development of OSI Model in software and transferred technology to the Department of Telecommunications.


Mr. Seturaman Mahalingam graduated from Sydenham College of Commerce and Economics, Bombay University in 1967 with a B.Com(Hons) degree. He then joined the leading firm of Chartered Accountants M/S G.P. Kapadia & Co and enrolled himself as Articed Clerk to qualify as a Chartered Accountant. He became an Associate Member of the Institute of Chartered Accountants in 1970 and later became a Fellow of the Institute of Chartered Accountants. He started his professional career with Tata Consultancy Services in 1970, as a Trainee. Mr. Mahalingam began his career as a programmer in the pioneering days of computer usage in India. Thereafter he worked as System Designer and thereafter took responsibility for managing Software Projects. He belonged to the early team of Software Professionals in TCS who were assigned to work on overseas projects. In 1974, he led a team of Software Professionals at TCS to design and develop a...
package for Building Societies in the UK. This was one of the earliest projects where the project work was carried out both in the United Kingdom and India. He designed the system based in the United Kingdom with his project team working in Bombay and later implementing the system in the UK. This pioneering project using off shore development capability, combined with on site design and management approach, enabled the overseas customer to get the benefit of accelerated development time with cost benefits. Mr. Mahalingam, after establishing himself as a project management professional, took on the responsibility of marketing software services for TCS. He set up the first international office of TCS in London in 1977, which looked after marketing software services in UK and Europe. He thereafter moved to New York to lead the marketing effort in North and South America. In these early days of software export, Mr. Mahalingam was one of the few leaders in the industry who created the business model which continues to be in existence even today. He moved to Madras (later renamed as Chennai) in 1983 where he was assigned the responsibility to develop a Centre which will handle domestic and overseas projects. Chennai operations of TCS grew substantially during the 20 years that he spent there. In 1988, he created India’s largest centre in terms of computing capacity with the installation of the latest IBM Mainframe computer and this centre, with its extensive data communication capability and with large numbers of computer professionals, met the needs created by overseas and domestic software projects. He was responsible for continuous addition and upgradation of the computing and service capabilities, making the Chennai operations handle a significant portion of TCS work at that time. He pioneered the concept of Software factory in 1998 when he established a large centre dedicated only to Y2K work. This centre set up in an industrial park at Chennai worked like a factory meeting the Y2K migration needs of customers world wide. As part of his responsibilities, he brought in Process Orientation, getting one of the first CMM Level 5 assessments in India. He also led the Training and Education effort at TCS, creating the model for Software Engineering Training.

Mr. Mahalingam created the first software campus for TCS by constructing an architecturally unique building, suitable for software work for large customers, at Sholinganallur in Chennai. He worked with the Government of Tamil Nadu in creating the IT corridor, which stretches southwards from Adyar. All the IT companies have a presence in this corridor known as Old Mahabalipuram Road.

Mr. Mahalingam was appointed as the Chief Financial Officer of the Company in February 2003. TCS was a Division of Tata Sons Ltd until 2004. As CFO, Mr. Mahalingam led the effort to transform TCS into a Public Limited Company in 2004, with its shares listed in Bombay Stock Exchange and National Stock Exchange. The Board of TCS appointed Mr. Mahalingam as Executive Director in August 2007. In his role as CFO and Executive Director, he has managed Finance, Investor Relations, Administration, Infrastructure Planning & Development, Information Systems, Risk Management and Legal Departments. Domestic and International Taxation have formed an important part of his responsibilities. Mr. Mahalingam has played a key role in helping TCS become a global company with sales of USD 11.6 Billion and employing over 275,000 employees as at the end of the Financial Year 2012-13. He retired from TCS in February 2013 after serving the company for over 42 years.

Mr. Mahalingam has been involved with Computer Society of India from the early days of his career. After moving to Madras in 1983, he became active as an Office Bearer at Madras Chapter. He was in the Organising Committee of Networks ’84. He was the Chairman of the Organising Committee of CSI Annual Convention held in Chennai in 1992. He was the Chairman of the Chennai Chapter during 1991-93. He has been an active participant in all the activities of CSI, both at the Chapter and at the National level. He was the President of CSI in 2009-10. He is currently in Charge of CSI Publications, which brings out the quarterly publication CSI Transactions on ICT.

Mr. Mahalingam’s experience as a leader in the IT industry has given him significant standing in Indian Industry. He is a former Chairman of the Southern Region of Confederation of Indian Industry (CII). He was also the President of the Institute of Management Consultants of India.

Mr. Mahalingam has been involved in the Skill development activity in India. He is on the board of a few companies. In addition, he continues his involvement with educational institutions, as Chairman of Bharathi Vidyalaya, a School in Chennai, on the Board of IIT Madras Research Park and in the Governing Council IIIT Delhi.

Mr. Mahalingam was chosen as the best ‘CFO’ in various years by Business Today, International Market Assessment (IMA), CNBC TV18, CFO Innovation, FinanceAsia and Institutional Investors. In 2012, Treasury & Risk, a US based magazine named him as one of the 16 globally most influential CFOs.

Mr. Mahalingam has served as a fine example of an IT professional who rose from the ranks and has helped India to become a significant player in the world IT scene.
He started his career with the Tata Institute of Fundamental Research and then went on to serve as Director, NCST where he played a significant role in creating India’s academic network, ERNET. His role in the ERNET project gave him and the colleagues in his team the opportunity to bring the Internet to India in 1987. He and his team played a significant role through their R&D, teaching and consultancy to spread the use of Internet technology in India in education, industry and business. Later, in 2001, he played a key role in setting up the HP Labs India, as its first director. He has served as President of the Computer Society of India (CSI) and of the International Council for Computer Communication. He has also served on the Expert Panel advising the ICT Task Force of the UN. He is a Fellow of the CSI and a Fellow of the National Academy of Engineering. He was inducted into the Internet Hall of Fame in 2014.

His contributions to the Computer Society of India include a key role in starting up CSI’s role in continuing education with the National Standard Tests in Programming Competence and related courses. He also contributed to CSI’s publications, working at various times as Editor, CSI Communications, Editor, CSI Journal and as Chair, CSI Publications Committee. He was Chair, Programming Committee of Networks 80 held in Mumbai in 1980, possibly the first international conference run by CSI. This conference involved cooperation with IFIP and was an early step in CSI’s cooperation with IFIP. Dr. Ramani served as an IFIP Trustee later on. He also contributed to several CSI conferences, particularly a series of Networks conferences held jointly with IFIP TC6. Dr. Ramani has also served as President of the South East Asia Regional Computer Confederation (SEARCC), representing CSI.

In grateful recognition of his services to the Computer Society of India (CSI) and IT industry, CSI is pleased to confer upon Dr. Srinivasan Ramani, the Life Time Achievement Award. The society takes pride and pleasure in recognizing him with this citation on the Occasion of its Golden Jubilee Annual Convention held at New Delhi on 02 December, 2015.
Dehradun Chapter

CSI organized a one day workshop on “Technology Enabled Science Education” in collaboration with Birla Institute of Applied Science, Bhimtal, Uttarakhand Science Education & Research Centre (U-SERC) and spoken tutorial project, IIT Mumbai in Droan College of Education & Technology, Rudrapur on 19.12.2015. The workshop was inaugurated by Chairman Mr. Kishor Kumar Sharma of Droan Educational Society. As a State Student Coordinator of CSI and representative of Uttarakhand Science Education & Research Institute, Spoken Tutorial IIT Mumbai, Dr. Ashutosh Bhatt expressed his views about the workshop. Being the main speakers, Mr. Abhay Sharma & Dr. Sandesh Tripathi awarded everyone and present their views in the workshop about the importance & use of Android (Operating System), a high modern education method and online lecture facility of spoken tutorial. In addition to this, they also provided the hands-on training. Director of U-SERC Prof. Durgesh Pant started earlier that U-SERC is working towards the establishment of knowledge corridor in Uttarakhand, under which 10,000 digital volunteer will be developed, which will aware people in various regions of the state about the importance & need of internet communication technology. The internet based modern education, will also be helpful in the development of the state.

The event took an end with the prize & certificate distribution by principal of Droan B.Ed. College Dr. Gurmeet Kaur, Assistant professor Mrs. Sheenu Arora, Ms. Shikha, Mr. Kultar Singh, Mr. Deshratna etc also participated in the event.

Gwalior Chapter

CSI Gwalior Chapter organized a computer and science quiz for school children at N.R.I.T.M. Gwalior on 9 - 10 December 2015. About 40 teams took part in the quiz. Mr. J.P.Verma, Chairman, CSI Gwalior Chapter, Mr. Hayaran Treasurer, CSI Gwalior Chapter along with Mr. Jayant S. Bhide, Past Chairman were present in the inaugural program. Director Mrs. S. Singh, Principal Dr. Awasathi and faculties of N.R.I.T. M. Gwalior were also present during the program. 4 teams entered in the final. Schools were well prepared for the quiz and presented their talent, which was appreciated by all. First three teams were awarded with prizes. Mr. Jayant S. Bhide and Mr. R.K. ishwakarma Past chairman were present during valedictory. All the CSI members were felicitated. It was also discussed that soon CSI Student Chapter will be processed.

Hyderabad Chapter

CSI Hyderabad chapter organised a Student Branch Tech Meet on 19-12-2015 at UGC Auditorium, JNTUH, Hyderabad. Mr. K. Mohan Raidu, convener - CSI Hyderabad Chapter made a welcome address by giving a brief about various Sessions of the event at this second Student Branch Tech Meet. The event was a grand success with 300 student participants and 30 SBCs. Mr. K. Mohan Raidu has launched two programmes during the event,

1. Software Project Life Cycle Learning Initiative from CSI Hyderabad Chapter for the Students
2. 100% Digital literacy Programme in an adopted Village by Each Engineering College.

Mr. Gautam Mahapatra, Chairman of CSI Hyderabad Chapter; Mr. Raju Kanchibotla, The Regional Vice President and Mr. C. Srinivasa Rao the State Student Coordinator participated in the event.

Major General Dr. Shiva Kumar, the Chief Guest of the Event, explained the National Policy on Data Sharing and Data Access. Mr. V. Srinivasa Rao, CEO & Managing Director for BT&BT (Better Today & Better Tomorrow) and guest of honor for the event presented an invited talk on Digital Engineering powered by Digital Technologies. Prof. Venkata Ramana Reddy, Director, University Industry Interaction Center, JNTUH has mentioned that JNTUH offers Big Data Analytics as one of the electives available to students, and requested CSI to provide resources
to the colleges for teaching and student project support for the electives. Mr. Srinivas Chintakindi mentioned about the paper he has published along with Mr. Balarama Varanasi, which aims to provide technology application mentoring for student chapters, and that a webinar will be conducted in near future to explain the details. Mr. Laxmi Kiran from CISCO, Bangalore clarified that hacking is generally understood as unauthorized access into a system while it is defined as determining the vulnerabilities of the information infrastructure to defend them better. Ms. Jyothi Para explained the importance of “professional certifications”, how they give global recognition for professional expertise. Mr. Adithya Vardhan from Verizon explained how web services and protocols support inter-operability among the platforms. Mr. Srinagesh from Infosys delivered as session on industry expectations. Mr. Anoop Kumar of CDAC technologies explained the what, why, who, where, when and how of the “smart cities” initiative. Mr. Rayalu emphasized on the importance of entrepreneurship, and inspired the students to start a company and become job providers instead of joining the crowd as a job seeker. He expressed dismay over the fake projects of the students and requested them to take up original projects. Mr. Venkat delivered a session on SEO opportunities and explained the differences between the on page optimization and off page optimization, and inspired the youth to consider SEO careers.

Jabalpur Chapter

First meeting of CSI Jabalpur chapter committee members, after its revival was held on 12 Dec. 2015 at GGITS, Jabalpur. Prof. Vimmi Pandey (Member, Nomination Committee), Prof. Meghna Utmal, Prof. Amit Sahu, Prof. Ashish Mishra, Prof. Jitendra Kulkarni (Treasurer), Dr. Santosh Vishwakarma (Hon. Secy.), Er. Shivaji Chaudhary (Vice Chairman), Dr. Vinip Tyagi (RVP Region III), Prof. Ashok Verma, Prof. Hare Ram Shah, Prof. Ajay Lala attended the meeting. MC members gave various suggestions to increase the activities of CSI Jabalpur chapter.

CSI Jabalpur chapter organised an International conference on Computational Intelligence and Communication Network 12th - 14th December 2015 at Gyan Ganga Institute of Technology & Sciences, Jabalpur. The conference was jointly organized with Machine Intelligence Research Labs, Gwalior and IEEE. The conference has generated widespread response across the globe. Approx. 790 papers were received from various countries like USA, UAE, MALASIA, Argentina, Sri Lanka and India.

The conference was sponsored by Madhya Pradesh Council of Science and Technology (MPCST), Bhopal. The Representative from MPCST, Mr. Nipul Shalawat was present during the inaugural and technical session. MPCST provided the generous financial sponsorship. The support and good wishes of MPCOST elevated the spirit of the conference. The relevance of the conference was well recognised by the corporates of this field. TCS, CISCO, etc. also provided sponsorship towards this event.

The Inaugural function marked the beginning of the Conference. The Chief Guest of the Inaugural Function was Dr. Dharma P. Agrawal. Dr. Ohio Board of Regents Distinguished Professor and Director, Center for Distributed and Mobile Computing, EECS Department, University of Cincinnati, Cincinnati, OH. The esteemed Guest of honour in the Inaugural Function was Mr. Arvind, Delivery Head TCS India and Dr. Vipin Tyagi, Vice President, Region III, Computer Society of India. Dr. Dharma in his inaugural speech highlighted that computational intelligence is likely to enter every field of life. Mr. Arvind from TCS said that distance of world has reduced due to communication network. Dr. Vinip Tyagi stressed that research should be towards making technology easy and society shall be benefited by the research outcomes. Shri D. C. Jain, Chairman, Gyan Ganga Group recognised the laurels brought by Indian researcher & engineers. Total 108 technical papers were presented in three days under 9 tracks. The detailed of the tracks, papers, sessions, etc. is enclosed to this report.

The conference was concluded through valedictory function. Dr. Santosh Vishwakarma proposed vote of thanks. The idea & theme was appreciated by all.

Trivandrum Chapter

Prof. Bipin Mehta, President CSI visited CSI, Trivandrum Chapter premises on 9th December, 2015. Shri Sreekanth P. Krishnan, Chairman welcomes him in the MC meeting of the chapter. Prof. Mehta discussed various initiatives of CSI for the members and students. He appreciated the efforts of OBs and MC members for organizing various events for the professionals and members including partnering with Kerala State Government for Knowledge Sharing Summit 2015, hosted by Kerala State on 10th and 11th December, 2015. MC members also gave few suggestions about the visibility of CSI
CSI Vellore Chapter organized a two day’s Faculty Development Programme (FDP) on “Role of Sensors in Internet of Things” on 11-12-2015 and 12-12-2015 at VIT University. Mr. Surya Prakash Singh, Manager Sensors Division, Freescale, Bangalore covered Introduction to sensor, types of sensors, role of sensors in different verticals like healthcare, transportation, retail etc. and demonstrated all types of sensors in healthcare, around 45 faculty members and SBC’s under the Vellore chapter attended the FDP, organized by Prof. G. Jagadeesh and Prof. K. Govinda.

### Computer Society of India Young IT Professional (YITP) Awards Call for Nominations

The nominations are invited from young IT professionals below 35 years of age (on 31st March, 2016) who are either working professionals, entrepreneurs or researchers and has made significant innovation in the areas of research, academics, IT applications and services to bring improvement in service, support and training in the field of Information Technology for CSI YITP awards under following categories:

**Division 1:** Hardware: Hardware development, Cloud implementation

**Division 2:** Software: Information Security, Artificial Intelligence, BFSI, Manufacturing, Retail, Multi lingual applications, Applications for rural development, Medicine or Health care Equipment’s

**Division 3:** Applications: Multi lingual applications, Applications for rural development, Medicine or Health care Equipment’s, Fashion industry / art, Public transport, BFSI, Manufacturing, Retail, Gaming

**Division 4:** Communications: Telecom, Mobile computing

**Division 5:** Education and Research: E-learning, Animation Industry

Nominations should be made in the prescribed format available on www.csi-india.org and with the regional YITP Conveners. The last date of national round will be informed by regional YITP conveners. National Round will be held on 4th March, 2016 at Udaipur.

**Regional Conveners:**

- **Region-I:** Mr. Vishal Jain - CSI Delhi/NCR Chapter, vishaljain_usit@yahoo.in
- **Region-II:** Dr. Ambar Dutta - CSI Kolkata Chapter, ambardutta@gmail.com
- **Region-III:** Mr. Vijay Shah - CSI Ahmedabad Chapter, vijaykshah64@hotmail.com
- **Region-IV:** Dr. Amit Joshi - Udaipur Chapter, amitjoshiudr@gmail.com
- **Region-V:** Dr. Brojo Kishore Mishra - CSI Odissa Chapter, brojokishoremishra@gmail.com
- **Region-V:** Dr. Praveen Krishna - CSI Vijaywada Chapter, praveenkrishna@csi.org
- **Region-VI:** Dr. Manish Kumar - CSI Bangalore Chapter, manishkumarjr@yahoo.com
- **Region-VII:** Dr. Vivek Deshpande - CSI Pune Chapter, vsd.deshpande@gmail.com
- **Region-VII:** Dr. Shubham Joshi - CSI Pune Chapter, shubhamjoshi@ieee.org
- **Region-VII:** Mr. N. Valliappan - CSI Coimbatore Chapter, valliappan@ezvidya.com

For further details contact: Dr. Nilesh K. Modi, National Convener, Young IT Professional Awards, Computer Society of India, nilesh@drnileshmodi.in, yitpawards@csi-india.org | +919662640500
CSI SIG on e-Governance

Kerala State IT Mission (KSITM), organized 7th National eGovernance Knowledge Sharing Summit (KSS-2015) in association with CSI’s Special Interest Group on e-Governance (CSI-SIGeGov) at Thiruvananthapuram on 10th and 11th December 2015. The event had Digital Kerala as its theme.

Mr. Mohammed V. Safirulla, IAS, Director – KSITM in his Welcome Address shared with the dignitaries and participants from Government departments, HODs and eGov community the importance of the Summit. Mr. P. H. Kurian, IAS, Principal Secretary (Industries & IT Govt. of Kerala) gave the presidential Address and described the preeminent position of the State in the implementation of ICT initiatives. The Inaugural address was given by Mr. Jiji Thomson, IAS Chief Secretary to the Government of Kerala. He laid out the historic background of ICT implementation challenges in the Govt. of Kerala in his Address. He highlighted the high volume of transactions relating to e-Gov services recorded on the eTaal portal and emanating from the state and described how – from a pan-India perspective - the number was next only the States of Andhra Pradesh and Telangana.

Prof. Bipin V. Mehta, President, CSI gave the Keynote Address on Digital India in which he highlighted Jeevan Pramaan and MyGov portal as the benchmark examples of electronic participation. Mr. Surendra Kapoor, Chairman CSI SIGeGov described the objectives of KSS and applauded the Kerala State’s various achievements in the eGov sphere. Mr. Ajith S., Head, eGovernance – KSITM gave the Vote of Thanks.

Three technical sessions were held on the first day [10th December]. The first session New Age Financial Inclusion was moderated by Prof. Harish P. Iyer, Research Center for eGovernance (RCeG), IIIT Hyderabad. The panelists included Shri V K Baby, IAS, (Secretary FR, GoK). The panel concluded that the financial inclusion was as much a business model as it was a goal of public policy. The panelists acknowledged the importance of the role of Banking Correspondents (BC) in the overall scheme of financial inclusion. Shri A. Babu, IAS, Collector & District Magistrate from Krishna District of Andhra Pradesh highlighted the JAM model [Jhan Dhan yojana / Aadhaar / Mobile] and explained how it had helped improve the finances of disadvantaged families in the district. The other panelists Shri John Philip, DGM [New India Assurance] and General Manager (BB & SR), State Bank of Travancore also shared their views. The second session was on Technological Perspective and was moderated by Dr. Piyush Gupta, Sr. VP, NISG New Delhi. The panelists were Dr. Ratan Kelkar IAS (CEO, CeG, GoK), Shri A. K. Balani, Sr. Director, DeIY, Gol; Shri Khobragade IAS and Shri Vakul Sharma (Supreme Court Advocate). The panel discussed Enterprise Architecture, Cyber Laws, and how the Hand-helds had become the devices of choice and how the Cloud should be the de-facto option. The panel also discussed various myths and realities surrounding cyber laws. The third session had Vibrancy as its Perspective and was moderated by Shri B. Ramani, ED, CDAC-Trivandrum. He and his panelists deliberated on promoting entrepreneurship in ICT in order to add vibrancy to the domain of eGovernance. A key point highlighted was that while the Government should do everything within its means to support entrepreneurship, start-ups should not build a business model which primarily depended on government patronage. The panel members were Dr. Jayasankar Prasad, CeO, Kerala Startup Mission; Shri M. Sivasankar, IAS (Secretary Power and KSEB Chairman) and Shri W. R. Reddy IAS (Principal Secretary, Taxes, Govt. of Kerala).

The second day of the summit commenced with the fourth session of the event and dealt with Cyber Security. The session was chaired by Mr. V. K. Bhadrar, Associate Director, CDAC and the panelists included Shri Sachin Burman, Director (NCIIPC), Shri B. J. Srinath (DG-ICERT – Addl In-charge); Shri Manoj Abraham, IPS (IG-TVME Range) and Dr. K. Rama Subramaniam, CEO (Valient Technologies, UAE). The Cyber dome – an initiative of Kerala involving the Police, the ICT industry, the trade bodies and the citizens was described in detail. Among the topics discussed were security issues relating to IPv6 and the Internet of things. The panel stressed that the government should learn from the manner in which the private sector manages security related tasks through a professionally constructed support structure. The fifth session Health Perspective Chaired by Mr. G. S. N. Prabhu, Convener - CSI Nihilent eGov Awards - along with his panelists shared the experiences on eHealth and Tele-medicine. The panel discussed the current Government Hospital Systems and compared the practices and processes of Corporate Hospitals with Government run ones. The panel drew attention to how big data and the mobiles are likely to transform various practices in the health sector. The members of the panel were Shri S. Ramakrishnan, Former DG, C-DAC; Dr. Jayan, Asst Professor, Medical College, Trivandrum; Shri Sasi P. M., Associate Director, C-DAC, Trivandrum. The sixth and the final session of the summit was on Openness Perspective. The panel chair was Mr. Satish Babu, Former President of CSI along and the members of the panel were Dr. K. S. Rajan from IIIT Hyderabad, and Shri R. Srinivasan, Former Chairman, IEE Kerala and Dr. Achuthsankar S. Nair, Director, Internal QA Cell, University of Kerala discussed how open standards, open software and open data were all related and yet were quite different. The panel deliberated on why it was important to understand the different types of licenses and how a vibrant Open Source developer and user community could help empower the e-Governance community.

In the valedictory session – Dr. Ratan U. Kelkar, IAS [CEO, Centre for eGovernance – Govt. of Karnataka] summarized the key observations from each of the six sessions. In his remarks, Shri S. Adikeshavan, CGM (Commercial banking) of State Bank of Travancore - a sponsor of the event – expressed the bank’s readiness to work with KSITM on several of the actionable points which emerged from the summit.

Congratulations to the Kerala State IT Mission and the Govt. of Kerala for organizing an excellent Knowledge Sharing Summit for the eGov fraternity!!
## FROM STUDENT BRANCHES

### REGION - III

<table>
<thead>
<tr>
<th>Institute</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNM INSTITUTE OF INFORMATION TECHNOLOGY, JAIPUR</td>
<td>19-9-2015 - during the event on CSI Plenum</td>
</tr>
<tr>
<td>LNM INSTITUTE OF INFORMATION TECHNOLOGY, JAIPUR</td>
<td>31-10-2015 &amp; 1-11-2015 - during two day workshop on Cloud Computing</td>
</tr>
</tbody>
</table>

### REGION - III

<table>
<thead>
<tr>
<th>Institute</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATRUSHRI L J GANDHI (BAKORVALA) BCA COLLEGE, MODASA</td>
<td>4-11-2015 - during Seminar on Satellite Communication</td>
</tr>
</tbody>
</table>

### REGION - IV

<table>
<thead>
<tr>
<th>Institute</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAKIR MOHAN UNIVERSITY, BALASORE</td>
<td>27-11-2015 - during State Level Student Convention (Odisha State)</td>
</tr>
</tbody>
</table>

### REGION - V

<table>
<thead>
<tr>
<th>Institute</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>G PULLAIH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL</td>
<td>15-10-2015 - Dr. A. P. J. Abdul Kalam’s birthday celebration as Youth Technical Day inaugurated by Dr. Prem Kumar</td>
</tr>
<tr>
<td>G PULLAIH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL</td>
<td>9-10-2015 - during one day National Level workshop on ETHICAL HACKING</td>
</tr>
</tbody>
</table>

### REGION-V

<table>
<thead>
<tr>
<th>Institute</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>M L R INSTITUTE OF TECHNOLOGY, HYDERABAD</td>
<td>12 &amp; 14-12-2015 during Two days Expert lecture on Web and Android Application Development</td>
</tr>
<tr>
<td>M L R INSTITUTE OF TECHNOLOGY, HYDERABAD</td>
<td>17-12-2015 - during one day workshop on Mobile Computing and Mobile Application Development</td>
</tr>
</tbody>
</table>
## FROM STUDENT BRANCHES

<table>
<thead>
<tr>
<th>REGION-V</th>
<th>REGION-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBKR INSTITUTE OF SCIENCE AND TECHNOLOGY, NELLORE</td>
<td>NBKR INSTITUTE OF SCIENCE AND TECHNOLOGY, NELLORE</td>
</tr>
<tr>
<td>2-12-2015 – during World Computer Literacy Day</td>
<td>18-12-2015 – during Technical Quiz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REGION-V</th>
<th>REGION-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUDLAVALLERU ENGINEERING COLLEGE, GUDLAVALLERU</td>
<td>VIDYA VARDHAKA COLLEGE OF ENGINEERING, MYSURU</td>
</tr>
<tr>
<td>26 &amp; 27-11-2015 – during Two Days Workshop on Internet of Things</td>
<td>6-11-2015 - Dr. R. Srinivasan, Past President, CSI &amp; Professor, MSRIT, Bengaluru inaugurated the CSI Student Branch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REGION-VI</th>
<th>REGION-VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>K K WAGH INSTITUTE OF ENGINEERING EDUCATION AND RESEARCH, NASHIK</td>
<td>NANDHA COLLEGE OF TECHNOLOGY, ERODE</td>
</tr>
<tr>
<td>18 &amp; 19-12-2015 – students during Two Day Workshop on Software Engineering</td>
<td>7 to 10-12-2015 during four Days CVAC Training Program on Mobile Application Development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REGION-VII</th>
<th>REGION-VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>S K R ENGINEERING COLLEGE, CHENNAI</td>
<td>EINSTEIN COLLEGE OF ENGINEERING, TIRUNELVELI</td>
</tr>
<tr>
<td>Date</td>
<td>Event Details &amp; Contact Information</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 21st Jan 2016| IT 2020 Annual Technology Conference in Association with Physics Dept. University of Mumbai  
www.csimumbai.org/it2020-15  
Contact: Tel : 022 28235476 / 28235548 / 29261711 / 29261734  
Email: info@csimumbai.org, csimumbai@vsnl.com |
| 22-23 Jan 2016| CSI MP State Student Convention, ITM University Gwalior, www.itmuniversity.ac.in  
Contact: Dr. Kapil Govil, Mobile : 8085857444, csimpssc@gmail.com |
| 12-13 Feb 2016| 10th National Conference on IT For Defence-2016  
Contact: Dr. R.K. Ramathan, rkramathan@gmail.com, tenthitd2016@gmail.com  
| 20-21 Feb 2016| International Conference on Communication and Network ComNet 2015 at Ahmedabad Management Association, ATIRA Campus, Ahmedabad 380015  
www.comnet2015.org  
Contact: Email id comnet2015@csiahd.org |
| 26-28 Feb 2016| 3rd International conference (ICIREMPS-16) on Advances in Electronics, Computer & Mathematical Sciences, Sponsored by M P Council of Science and Technology, Bhopal  
Technically supported by CSI Bhopal Chapter, CSI Region III, Venue: Sagar Group of Institutions, Bhopal  
Contact: Rajesh K Shukla, Mob: 09893192616  
Email: rkmardmnh@gmail.com www.sirtbhopal.ac.in/iciremps, mail id: iciremps@gmail.com |
| 4-5 March 2016| Second International Conference on ICT for Competitive Strategies (ICICS-2016) at Udaipur (Organized by ACM  
Udaipur Chapter, in association with CSI Udaipur Chapter)  
www.csu-udaipur.org/licitcs-2016  
Contact: Mr. Amit Joshi amitjoshiudr@gmail.com |
| 5 March 2016  | CSI Gujrat State Student Convention, Scool of Computer Studies, Ahmadabad University, www.aesics.ac.in/ssc  
Contact: Tel : (079) 26402932, 26402987, Email: rsc3@aesics.ac.in |
| 10-11 March 2016| First National Conference on Data Engineering and Communication Technology-ICDECT at LAVASA, Pune  
www.icdect.com  
Contact: Prof. Suresh Limkar icdect2016@gmail.com, 9823328686 |
Organized by Bharati Vidyapeeth’s Institute of Computer Applications and Management (BVICAM) New Delhi  
www.bvicam.ac.in/indiacom  
Contact: Prof. M. N. Hoda, Conference@bvicam.ac.in, indiacom2016@gmail.com |
| 18-19 March 2016| National Seminar on “Assemblage of Digital Era -2016” Venue: The Bhopal School of Social Sciences, Bhopal  
Contact: Jincy Renjy Thomas, Email-Id: jincyrenjy78@gmail.com |

Kind Attention: Prospective Contributors of CSI Communications

Please note that Cover Themes for forthcoming issues are planned as follows:

- February 2016 - Computer Networks
- March 2016 - Digital Forensics

Articles may be submitted in the categories such as: Cover Story, Research Front, Technical Trends and Article. Please send your contributions before 20th Jan. 2016 for February issue. The articles may be long (2500-3000 words maximum) or short (1000-1500 words) and authored in as original text. Plagiarism is strictly prohibited.

Please note that CSI Communications is a magazine for members at large and not a research journal for publishing full-fledged research papers. Therefore, we expect articles written at the level of general audience of varied member categories. Equations and mathematical expressions within articles are not recommended and, if absolutely necessary, should be minimum. Include a brief biography of four to six lines, indicating CSI Membership no., for each author with high resolution author photograph.

Please send your article in MS-Word and/or PDF format to Dr. Vipin Tyagi, Guest Editor, via email id dr.vipin.tyagi@gmail.com with a copy to csic@csi-india.org.

(Issued on the behalf of Editorial Board CSI Communications)

Chief Editor
CSI-2015
Golden Jubilee Annual Convention
December 2-5, 2015