The first two decades of the twenty-first century have also seen the birth of new organizations like NPCI, new players in the banking system like payment banks, new challenging yet cooperating entities called FinTechs and game changers like PPIs and P2Ps. Innovation has been the key to open new vistas of the banking.

In 1998, Dr. Abdul Kalam, a great visionary, put forward a countrywide plan called Technology Vision 2020, which he described as a roadmap for transforming India from a less developed to a developed society in 20 years. Taking a cue from his vision, there have been several documents detailing the path the country is likely to travel in different areas, including banking technology.

We all have witnessed the journey the country has undertaken in achieving the goal it set for itself about two-and-a-half decades back. In particular, we have seen the banking sector moving steadily towards what we today call the digital banking. During the journey, banks have adopted relevant technology, including the latest like artificial intelligence, to enhance efficiency of internal processes and efficacy of user interfaces. They ensured that it was only on rare occasions the customer needed to walk into a physical branch and that most of the services and interactions could be carried through the friendly mobile apps.

The first two decades of the twenty-first century have also seen the birth of new organizations like NPCI, new players in the banking system like payment banks, new challenging yet cooperating entities called FinTechs and game changers like PPIs and P2Ps. Innovation has been the key to open new vistas of the banking.

IDRBT, a unique Institute established by Reserve Bank of India, has throughout this period been playing a key role in the digital transformation of the banks. During the first two decades, it has focussed on building robust secure infrastructure, which was the need of the hour. The activities included setting up critical nationwide infrastructure like NFS (National Financial Switch), INFINET (Indian Financial Network), SFMS (Structured Financial Messaging System) and IBCC (Indian Banking Community Cloud). As these systems matured, the same were transferred to companies like NPCI and IFTAS. While NPCI took over NFS, the other services were taken over by IFTAS, a company promoted by IDRBT to manage them.

In the meantime, the Institute has redefined its role from providing infrastructure services to banking sector to an innovative hub working at...
the intersection of academia and industry. It brought the technology developments closer to banking community through international conferences, publications, forum meetings, training programmes and consultancy. Six centers have been set up over the past few years to do research in areas of relevance to banking like analytics, cyber security, cloud computing, payment systems, mobile banking and affordable technology. There are efforts on to set up two more innovative centers in the form of FinTech Exchange and 5G Use Case Lab.

Along with these rapid technological developments, grew the cyber threats. As banks have been building systems to provide services to customers any time, fraudsters have been developing tools and techniques to attack the banks from anywhere. Cyber security has become the most important item on the agenda of the regulator, banks, service providers, academic institutions and naturally of the IDRBT.

Cyber security related activities of the Institute have been growing multifold during the recent past. In addition to conducting specific programmes on security, the Institute has been coordinating the banks CISOs’ Forum, which meets periodically to discuss the cyber security related issues concerning banking community. The Institute also helps banks by conducting cyber drills to help them assess the cyber security preparedness and identify gaps in their armour for fixing them. IDRBT also manages the cyber threat information sharing platform for banks – IB-CART. Keeping in line with the seriousness of the topic, the international conference hosted by the Institute during 2019 is also on Information System Security.

In addition to all these, the Institute has been working on a mission mode during the past year and quarter to increase cyber security awareness at senior and top level management of banks by conducting special certification programmes for board directors and senior management of banks. There have been so far 59 programmes covering 1946 officials. This mission mode activity of the Institute, I am sure, will prepare the banking sector to be ready to manage cyber risks more comprehensively and competently. Better the cyber security preparedness, greater the confidence in technology leading to faster pace of technology innovation and adoption by banks.

Happy New Year 2020! Now is the time to look beyond 2020!!

Place: Hyderabad
Date: January 01, 2020

(Dr. A. S. Ramasastri)
CONTINUING the practice of organising one good international conference every year, the Institute organised the 15th International Conference on Information Systems Security (ICISS 2019) from December 18-20, 2019.

The ICISS, held annually, is a premier international interdisciplinary forum, focused on disseminating the latest research in Information and Systems Security. This conference is of crucial importance for the banking and financial sector since the sector is amongst the most targeted domain of cyber-attacks. So, it is necessary that banks are abreast with the latest advances in the security space so as to be well-prepared against these attacks.

Dr. A. S. Ramasastri, Director, IDRBT, started the proceedings by spotlighting the unique positioning of the IDRBT at the intersection of academia and industry and the benefits of its focus on applied research in the areas of direct relevance to banking, especially the new initiatives such as FinTech Exchange and 5G Use Case Lab. He also dwelt upon the latest developments in the areas of academics and executive education, with a particular focus on the contributions in the areas of Cyber Security, Analytics, Cloud Computing, Payment Systems, Mobile Banking, Affordable Technologies and the patents the Institute has received on various facets of Cyber Security.

Shri G. Padmanabhan, Non-Executive Chairman, Bank of India and former Executive Director, Reserve Bank of India, inaugurated the ICISS 2019. In his inaugural address, Shri Padmanabhan flagged the following:

- The productivity of banks and financial institutions have increased multi-fold after inclusion of cyber in their delivery channels. But it has also resulted in various threats and challenges to ensure safety for wired as well as wireless transactions. The Banking and Financial Sector is the most vulnerable and most targeted as money is involved.
- The challenge of protecting open and faster delivery channels riding on blockchain coupled with 5G gets immense when "walls and roof" of banks are vanishing.
- In the Indian context, when 3-4 vendors have rolled out banking solution for the entire banking industry, if a security lapse is exploited by one rogue, then almost all banks using that solution become potentially vulnerable.
- In the year 2018, cyber-attacks on India had increased by more than 100% over the previous year as against the corresponding global increase of 35%. India was the 2nd most targeted country for cyber-attacks in the world, after the US.
- Threat hunting, segmentation of networks, regular data backup, implementation of multifactor authentication, finetuning SoC alerts can help in containing cyber-attacks better.
- Countering cyber threats calls for dedicated
and continuous research to monitoring evolving threats and counter measures. The financial sector depends heavily on academia for this. I suggest that the financial sector come together to fund such research on an ongoing basis. This would enable the institutions to be proactive rather than be reactive in dealing with cyber-attacks.

- Ideally, the solutions emerge from academia, which are then delivered to banks through fintechs and IT companies. It is in this context that institutions like IDRBT which are at the intersection between industry and academia are playing an important role.

A galaxy of renowned international researchers in the area of Information and Systems Security including the following participated in the ICISS – 2019 and delivered keynote talks:

- **Karthikeyan Bhargavan**, directeur de recherche, Institut national de recherche en informatique et en automatique (INRIA), Paris, on “Secure Messaging: Towards Verified Standards & High Assurance Implementations”.
- **Krishna P. Gummadi**, Head, Networked Systems Research Group, Max Planck Institute for Software Systems (MPI-SWS), Germany, on “Privacy, Fairness, Transparency, and Abuse of Targeted Advertising on Social Media”.
- **Reza Shokri**, Assistant Professor of Computer Science, National University of Singapore (NUS) on “Trusting Machine Learning: Privacy, Robustness, and Interpretability Challenges”.

This three-day conference was preceded by a two-day tutorial on December 16 – 17, 2019 on Digital Forensics – Process, Tools and Challenges, Capitalizing on DevOps and Android Malware Prediction using Machine Learning Techniques.

Seventeen research papers, covering the areas of Smart Contracts, Formal Techniques, Access Control, Machine Learning, Distributed Systems, Cryptography, Online Social Networks and Images and Cryptography, authored by leading global researchers including from Moscow State University, Russia; University of Kentucky, USA; Norwegian University of Science and Technology, Norway; University of Cauca, Columbia; University of Minho, Portugal; Peking University, China; etc., were presented. The acceptance rate of the conference was 23.29%.

The IDRBT, this year, instituted the "IDRBT Best Practice Paper Award" to encourage and tap into the novel ideas presented at the ICISS. The paper titled "Policy Reconciliation and Migration in Attribute Based Access Control" authored by Gunjan Batra, Vijayalakshmi Atluri, Jaideep Vaidya from Rutgers Business School and Shamik Sural from IIT Kharagpur, won the inaugural IDRBT Best Practice Paper Award.

Dr. N. V. Narendra Kumar, IDRBT & Dr. Deepak Garg, Max Planck Institute for Software Systems, co-chaired the ICISS 2019.
IIBF – IDRBT Research Fellowship in Banking Technology

In a new initiative aimed at enabling talent in the area of Banking Technology, the Indian Institute of Banking & Finance (IIBF) and IDRBT have jointly launched a “Research Fellowship in Banking Technology.”

This fellowship, will sponsor a technically and economically feasible research project, which has the potential to contribute significantly to the Banking and Financial Sector in the areas of Cyber Security, Analytics, Mobile Banking, Emerging Technologies, Payment Systems.

The selected research project carries a cash award of Rs. 5,00,000/- (Rupees Five lakhs only) and is expected to be completed in six months. The last date for receipt of applications is January 14, 2020.

New Patent

The Institute has been granted an US Patent (Number 10498537) for its work on “System and Method for Providing Secure Collaborative Software as a Service (SaaS) Attestation Service for Authentication in Cloud Computing,” on December 12, 2019.

With a view to enable scalability and availability with the security services in a SaaS delivery model, the patent describes an authentication framework that works as a collaborative service attestation for authentication in cloud computing. The described framework is facilitated with a novel hierarchical certificateless aggregate signature scheme to provide authentication and non-repudiation for SaaS.

The work for the patent was carried out by Dr. G. R. Gangadharan and Deepnarayan Tiwari.

New Sponsored Projects

Developing Data Science Framework, Architecture and Methodology for Fraud Detection in ATM Transactions in Banks

The Department of Science and Technology, Govt. of India, has awarded the Institute a research project titled “Developing Data Science Framework, Architecture and Methodology for Fraud Detection in ATM Transactions in Banks” in collaboration with C-DAC.

This project aims to work out a framework, architecture and methodology in the paradigm of big data to analyze the structured and unstructured data that the ATM transactions are replete with, in order to detect and prevent ATM frauds in near real time.

Dr. V. Ravi, Faculty, is the investigator from IDRBT and Ms Supriya N. Pal, Senior Director, is the investigator from C-DAC.

Hardware Trojan Detection in PCBs using X-Ray Images, DRDO

The Defence Research and Development Organization (DRDO) has awarded the Institute a research project titled “Hardware Trojan Detection in PCBs Using X-Ray Images”, in collaboration with Indian Statistical Institute, Kolkata.

The project aims to detect malicious components (trojans) in the hardware using x-ray images of the hardware. In the context of this project, hardware refers to printed circuit boards (PCBs). A reconstructed model of the test PCB will be compared against a reference model to find out the additional/malicious components in the hardware so as to deliver a method based on structural analysis to detect if a test PCB contains malicious additional hardware component. In the wake of several cyber attacks...
using hardware trojans, this project aims to make important contributions in devising a novel method for hardware trojan detection.

Dr. Rajarshi Pal, Faculty, is the investigator from IDRBT and Prof. Ashish Ghosh, Indian Statistical Institute, Kolkata, is the investigator from ISI, Kolkata.

Ninth IDRBT Doctoral Colloquium

The Annual IDRBT Doctoral Colloquium is an initiative aimed at discovering and exploring emerging areas of research in various domains of technology, sharing knowledge and forming a network of technology researchers. It intends to create a platform to collaborate, and exchange research ideas, thereby exploring the opportunities for innovation in the Indian Banking and Financial Sector.

Taking this initiative forward, the Institute organised the Ninth IDRBT Doctoral Colloquium on December 09, 2019. Eleven Research scholars from reputed institutions like IITs, ISI and IIITs, presented their research in the Colloquium.

A Jury consisting of Dr. Shalabh Bhatnagar, Indian Institute of Science, Bangalore; Dr. Kannan Srinathan, International Institute of Information Technology, Hyderabad and Dr. Chakravarthy Bhagvati, University of Hyderabad, evaluated the paper presentations on the parameters of Originality, Depth of Work (Modelling, Design, Experimentation, Results), Technical Content (Models, Optimization, Technologies, Analysis), Presentation (PPTs, Graphs, Explanations, Language, Clarity), Relevance (Applicability, Modernism) and Correctness of Work (Correct, Complete, Gaps).

The Winners

- **First Prize:** Ms. Ankita Mandal, Indian Statistical Institute, Kolkata, for her contribution entitled Scalable Regularized Canonical Correlation Analysis for Multimodal Omics Data. The 1st prize consisted of INR 1 lakh and a citation.
- **Second Prize:** Mr. Daksh Thapar, Indian Institute of Technology, Mandi, for his contribution entitled Multi-view and cross-angle gait based behavioural biometric recognition system using Deep Learning. The 2nd prize consisted of INR 50,000/- and a citation.
- **Third Prize:** Mr. Hridoy Sankar Dutta, Indraprastha Institute of Information Technology, Delhi, for his contribution entitled CoReRank: Ranking to Detect Users Involved in Blackmarket-based Collusive Retweeting Activities. The 3rd prize consisted of INR 35,000/- and a citation.

The Colloquium was coordinated by Dr. Mridula Verma and Dr. Abhishek Thakur, Faculty, IDRBT.
Post Graduate Diploma in Banking Technology

THE Convocation for the third batch of the Institute’s Post Graduate Diploma in Banking and Technology (PGDBT), which completed their course requirements in June 2019, was held on September 05, 2019.

Dr. A.S. Ramasastri, Director, IDRBT, presented the Diplomas, to the successful students. Speaking on the occasion, he advised the students to keep their unwavered focus on continuous learning, for change is a constant in technology and it becomes obsolete quickly. Exhorting them to work hard and contribute well to the banks which have recruited them, he pointed out that being students of IDRBT, banks have high expectations from them, and they need to live up to them.

With a view to encourage the PGDBT students to raise the bar and perform better, the Dr. A. S. Ramasastri Gold Medal for the topper of the PGDBT Programme, was instituted on the occasion. The funds for this medal and accompanying citation were contributed by Dr. A.S. Ramasastri, Director, IDRBT. Shri Sreekanth N, won the inaugural Dr. A.S. Ramasastri Gold Medal for scoring the highest marks in the 2018–2019 batch of PGDBT.

As in the case of the first two batches, during the third year too, the Institute clocked 100% placements by February 2019, i.e., all the students were placed even before the completion of the third term of the PGDBT. The recruiters this year were Kotak Mahindra Bank, South Indian Bank Ltd., Catholic Syrian Bank, and Federal Bank Ltd., and compensation ranged from Rs. 6–9 lakhs per annum.

The Fourth Batch of Post Graduate Diploma in Banking Technology commenced on July, 01, 2019. The Institute has also called for applications for the fifth batch of PGDBT, the details of which can be accessed from the Institute’s website www.idrbt.ac.in.
Certification Programme in IT & Cyber Security

In order to enhance the management’s awareness in banks on the IT and Cyber Security issues, in a systematic and structured manner, the Reserve Bank of India has stressed that the Members of the Board, Senior Management and CXOs need to undergo a Certification Programme in the areas of IT and Cyber Security.

The RBI has designed certification programmes customised for each category of the aforesaid participants, to be conducted by the IDRBT so as to enable them to contribute more effectively in the matters relating to planning and execution of the cyber security strategy of their bank.

Accordingly, the Institute is conducting Certification Programmes in IT and Cyber Security for the three specific target groups, segregated based on their roles in the banks, as under:

- Two-day Certification Programmes in IT & Cyber Security for Board Members
- Two-day Certification Programmes in IT & Cyber Security for Senior Management
- Five-day Certification Programmes in IT & Cyber Security for CXOs

During July 2019 – December 2019, the Institute conducted Five certification programmes for Board Members, Eleven certification programmes for Senior Management and Two certification programmes for CXOs. Overall, 530 participants from across public, private and foreign banks have been trained as part of the cyber security certification programmes during these six-month period. These included a customized programme for the Board and Senior Management of Kotak Mahindra Bank.

Further, the Institute has announced two programmes for Board Members, six programmes for Senior Management and one programme for CXOs respectively, during January – March 2020.

Executive Development Programmes

The Institute’s executive development programmes focus on equipping and preparing the top and middle-level managements of Banks and Financial Institutions for the latest in Technology Banking. The endeavor of the Institute through these programmes is finding the gaps in the skillset requirements and provide training in those areas.

The Institute offered 25 programmes during July 01 to December 31, 2019, in the areas of Registration Authority Operations, Data Centre Management, API Development, Big Data Analytics, Website Security, IT Project Management, Technologies for Financial Inclusion, Security Operations Centre, Information Systems Control and Audit, Dokerbization, API Security and Governance, Red Team and Blue Team Exercise, Payment and Settlement Systems, IT Vendor Management, Network Security, Secure Web Application Development, Open Source Technologies, Banking Technologies etc. Around 400 participants from various banks participated in these training programmes.

We also conducted Customised Training Programmes on Dispute Resolution in E-Banking and Electronic Payments for Banking Ombudsman of Reserve Bank of India, Data Analytics for SEBI, and Big Data Analytics for NABARD. Apart from these programmes, the Institute also conducted the Eighth International programme on Cyber Security in collaboration with University of Buffalo, USA.
Conference on Payment and Settlement Systems Vision 2021 and Deepening of Digital Payments

The RBI & IDRBT jointly organized a Conference on Payment and Settlement Systems Vision 2021 and Deepening of Digital Payments on October 16th, 2019. The conference started off with the opening remarks by Dr. A.S. Ramasastri, Director, IDRBT.

Shri S. Ganesh Kumar, Executive Director, Reserve Bank of India, stressed that since obsolescence of technology is faster than the rate at which innovations happen, the bankers need to get an idea as to what needs to be done to ensure:

* Competitive Differentiation
* The difference between two banks is what products and how they offer it to the customers
* Provide a worthy experience to the customer that will make the customer continue with the bank.

He also highlighted that “retaining customer attention is a challenge and profits of banks will be centered around Payment Systems, so there is a need to continuously evolve and come out with new and innovative Payment Systems.

Shri Dilip Asbe, Chief Executive Officer, National Payments Corporation of India, spoke on New Developments in Retail Payments, covering Regulatory Initiatives such as Regulatory Sandbox, 24/7 NEFT, White Paper for Regulation of Payment System, Waiver of charges, etc.

Shri P. Vasudevan, Chief General Manager, DPSS, RBI & his Team, lead a discussion on Payment and Settlement Systems Vision 2021 and Deepening of Digital Payments, which helped provide clarity on the way forward. Dr. N.V. Narendra Kumar, Faculty, IDRBT, spoke on Evolving Technologies in Payment Systems and coordinated the conference.
CIO Forum

The Eighth Meeting of the Indian Banks’ CIO forum, held on July 19, 2019, mainly focused on Payment Systems and Fintech Collaboration. In the area of Payment Systems, the following points were deliberated: while the banks are mandated to register an FIR in case of a forged currency note, there is no suitable parallel in the digital system - a single platform for the nation, the need for Govt., insurance and statutory payments to be excluded from the transaction count of BSBD accounts, and when many payment systems are co-existing, there may also be some sunset mechanism for payment systems whose usage is on the wane.

On Fintech Collaboration, the discussions centered on the need for digital identity with privacy data protection; Voice-based banking/Alexa and similar integration; USSD improvements – usability and other use cases; Check image analysis and context mining, etc. A Working Group to identify API standards and Use Cases was constituted so that the FinTechs can collaborate with banks more easily. The importance of dispute resolution and governance in API Management was also deliberated upon.

The last session – Open Forum – was devoted to discussing current issues of concern for CIOs, like Windows migration, C-KYC, Scope of Unplanned DR Drills, Escrow arrangements for critical applications and so on. Fruitful discussions took place on these and participants shared their tips and inputs for the benefit of the community. 14 CIOs participated.

CISO Forum

The Institute’s CISO Forum is serving as an effective platform for the CISOs of banks to discuss and resolve information security related issues. The CISO Forum meet, held once in every quarter, was held at IDRBT on August 19 – 20, 2019 and at Gurugram on November 21 –22, 2019.

CISO Meet on August 19 – 20, 2019

Shri G Narendranath, Joint Secretary, National Security Council, started the proceedings by spotlighting a wide range of cyber threats landscape for Banking Sector, especially from Phishing/Vishing attacks.

Strategies for enhancing Security Governance within a bank, essential Information Security measures that all banks should adopt, Tools that can be deployed by banks for cyber security management; Security Search Engines, Malwares, upgrading from SOC 2.0 to SOC 3.0, Mobile App Security, Extended Security Solutions using Biometrics backed by AI and Behaviour Analytics, NIST Cyber Security Framework, Application and Data Protection were the key issues discussed. The findings from the 18th Cyber Drill conducted on August 6, 2019 were also deliberated upon. 54 CISOs participated.

CISO Meet on November 21 – 22, 2019

The Oriental Bank of Commerce hosted this meeting of the CISO Forum held on November 21–22, 2019. Shri Mukesh Kumar Jain, MD & CEO, Oriental Bank of Commerce and Dr. A. S. RamaSastri, Director, IDRBT inaugurated the meet.
The meet deliberated on identification of critical information infrastructure, cyber security initiatives/circulars which are taken/issued by various Government/regulatory bodies, implementing Network Access Control (NAC) in an organization, ensuring cyber security in the event of merger between multiple banks, current cyber threat landscape, cyber insurance and resolving cyber security problems through machine learning techniques. 60 CISOs participated.

**CAO Forum**

The fifth meeting of the Chief Analytics Officers Forum was held at HDFC Bank, Mumbai, on December 05, 2019.

The meet first took up the theme-based panel discussion on Trends in Fraud Detection in banks by Predictive Analytics (subsuming AI/ML), which was moderated by Shri Manish Agarwal, Fraud Prevention Head, HDFC Bank. The theme was identified by the Management Committee (MC) of the Forum in its previous meeting held on February 20, 2019. This was followed by a presentation on Analytics initiatives of HDFC Bank and a session on Data Privacy and Security.

Thereafter, there were two Panel Discussions on the following topics: Fintechs as strategic partners for Banks: Challenges and Opportunity, which was moderated by Prof. V. Ravi, Coordinator, CAO Forum, IDRBT; and Growth of New Age Technologies in Financial Services such as Hadoop, Dialer Platforms and Voice Analytics, OCR, Cloud based services, IoT; which was moderated by Shri Ashish Abraham, Group Head, Analytics, HDFC Bank. 18 CAO’s participated in this meeting.

**FinTech Forum**

The Fourth meeting of the Fintech Forum was held on August 05, 2019. In the first session, four FinTechs demonstrated their products. In parallel, a platform demonstration session by Microsoft (Azure) and CDAC (Proof-of-existence) was held. In the second session, fourteen FinTechs presented their technologies that could solve various problems of banking domain.

A meeting of the FinTech Forum Advisory Committee was also held on the occasion, wherein it was decided to form four working groups focussing on web-portal, test-environment process, use-case shortlisting and environment enablers. It was also felt that it would be useful to classify the Fintechs as per their capabilities and focus areas. 35 Fintechs and 14 banks participated in the meeting.
New 5G Use Cases Lab for the Banking and Financial Sector

MOBILE technology has been marching ahead rapidly since the early 1980s when the 1G technology provided analog-based voice for human-to-human interaction. Then onwards, a new generation technology came into existence almost every ten years, providing better features and functionalities. While in the 2010s, the 4G ushered in the merger of internet and telecom networks with core network as an all IP network, the cyber world had started moving in directions of virtualization, cyber-physical systems, service-oriented architecture and so forth during the period.

To meet the emerging requirements, there has been considerable work around the development of the next generation network – 5G. The 5G network is likely to encompass not just the Internet but all the resources connected to Internet. In such a scenario, it is essential there is a greater preparedness from both the service providers and consumers regarding the principles, architecture and features of the new technology. Such preparedness will help all concerned to design, develop and deploy appropriate applications that can be used efficiently and effectively. It is often felt that a similar preparedness by various sectors could have helped a greater success of 4G.

With a view to enable this preparedness, the Institute launched the 5G Use Cases Lab for the Banking and Financial Sector in India on April 12, 2019, with the following broad objectives:

- Develop and Demonstrate 5G Use Cases for Banking and Financial Services
- Set-up 5G Research and Development Experience Platform for Banking and Financial Services
- Collaborate with Stakeholders - Banks, Government, Service Providers, MNO, Financial Institutions, OEM, Academicians, R&D Bodies, Standards setting bodies and Others for 5G promotion and absorption of best practices
- Create 5G Champions in Banking and Financial Services sector
- Provide state-of-the-art Experimental Test Bed Solutions for Mobile, Wireless Technologies, IoT and Security Services for BFSI
- Conduct Awareness and Capacity Building Programmes in the Frontiers of 5G and Beyond.

Shri Amit Yadav, Joint Secretary, Department of Telecommunications, Ministry of Communications, Govt. of India; launched the lab in the presence of Shri. R.K. Pathak, Deputy Director General, Department of Telecommunications, Ministry of Communications, Govt. of India; Smt. Anjana Dube, Deputy Director General, Department of Financial Services, Ministry of Finance, Govt. of India; Ms. Pamela Kumar, Director General, Telecommunications Standards Development Society, India and Dr. A. S. Ramasastri, Director, IDRBT.

Speaking on the occasion, Shri Yadav pointed out that "5G has already arrived with it being rolled out in the US and South Korea. Since India is now the
Dr. A. S. Ramasatri, Director, IDRBT, stressed on the importance of 5G and pointed out that the Tokyo Olympics in 2020 may see a splash of 5G. "So the time is right to start working on 5G so that India is a thought leader in this new technology, rather than being a follower as in the case of some earlier technologies. We will reap benefits and be able to leverage its advantages if we move fast. Multiple sectors and service providers need to work together to fully exploit the technology," he shared adding that the Institute will initially be focusing on proof-of-concepts, parallel runs and deployable solutions for banks.

Shri. R.K. Pathak, Deputy Director General, Department of Telecommunications, Ministry of Communications, Govt. of India, said that the 5G Use Case lab would contribute to new standards in the country and expressed happiness that IDRBT has made tremendous progress in a short span of 11 months, after the idea of a 5G Use Cases lab was first mooted. The Institute has successfully brought together multiple bodies like Department of Telecommunications, Department of Financial Services and Telecommunications Standards Development Society, India to work on the 5G initiative.

**Fourth Banking Technology Innovation Contest**

In the case of the banking and financial sector, there has been an emergence of Fintech companies that can contribute to innovation. Individual banks are collaborating with specific Fintechs to get new systems designed, developed and deployed. The difficulty in such a process is that each bank has to put in efforts to identify the right fintech partners. The difficulty the Fintech faces is that it has to knock on the doors of several banks not only for showcasing their product but also to develop the right product as there could be a gap in their understanding of requirements of banks. It is in this context that innovation contests are quite helpful.

IDRBT has been organising the Annual IDRBT Banking Technology Innovation Contest (IBTIC) every year since 2016. With a view to bring out latest innovations in the area of banking technology, the Institute organised the Fourth IDRBT Banking Technology Innovation Contest on April 12, 2019 at IDRBT.

This year, the contest attracted good response from across the country from start-ups, banks and IT companies. In order to ensure greater transparency and objectivity, the submissions were subjected to a rigorous screening process. An eminent jury shortlisted the Top-10 applications, which were invited for presentations. The 10-shortlisted teams
presented their innovations to the Chief Information Officers (CIO) Forum, which consists of IT Heads of various banks in India. Over ten CIOs of various public and private sector banks participated and judged the innovations during the IBTIC 2019.

Speaking on the occasion, Dr. A.S. Ramasastri, Director, IDRBT, invited all the innovators to work closely with the Institute so as to finetune these innovations and work towards implementing them in the Banking and Financial Sector. Smt. Anjana Dube, Deputy Director General, Department of Financial Services, Ministry of Finance, Govt. of India, was the Chief Guest. Speaking on the occasion, she flagged the following key issues:

- Fintech is an exciting space with a lot happening now. We need to channelize it so that we can derive more and better benefits.
- The innovators need to focus on designing products that are not only robust but also solve problems being faced by our people.
- While focusing on innovation, it is also important that we are in tune with the regulatory norms. So, it is important that the innovators have an understanding of these norms and comply with them.
- Interfacing start-ups, academics and practitioners is essential to make a product robust. IDRBT is uniquely placed to make this happen and this strength of the Institute needs to be leveraged for the greater good of the nation.

The Winners

First Prize: The innovation titled "Decision Intelligence using Satellite Big Data Analytics for Agricultural Credit Lending in India", presented by Team Satsure consisting of Pradeen Basu and Sarvesh Kurane, from Satsure Analytics India Pvt. Ltd, won the first prize of Rs. 60,000/-.

Second Prize: The innovation titled "Unification of Core Banking Involving Retail (Finware) & Wholesale (Ubs/Fcc/Fcr) into One Single Integrated Flexcube Core Banking", presented by Team IT Application Lifecycle Management consisting of Sanjay Desai, Vaibhav Samant, Gopakumar Panicker, from HDFC Bank, won the second prize of Rs. 45,000/-. 

Third Prize: The innovation titled "YONO" presented by Yono Team consisting of Sandeep Ubale, S. Rama Mohana Rao, and Niraj Kumar from State Bank of India shared the third prize of Rs. 30,000/- for the innovation titled "CANDI Branch" presented by Team Application Development and Maintenance consisting of L. Sankaranarayana, Abhishek Kumar, Navin Badge, Rachita Sinha and Swarna Saras from Canara Bank.
White Paper on 5G Applications

This White Paper is a step towards enabling preparedness of the banking and financial sector, which has very high reliance on communication technology for all its activities, on 5G. The paper, in addition to presenting the technology, principles, architecture and features of 5G, compiles a few use cases for the use of 5G by BFSI. It also addresses the security concerns, generally associated with financial transactions on such networks while presenting the enhancements and advancements over existing wireless technologies that BFSI can use for remodelling their current business practices.

The white paper, with its use cases for BFSI, is expected to serve as a good resource for all concerned with 5G, especially while designing sector-specific requirements. Particularly, it can be a good reference for Chief Digital Officers, CIO/IT Heads, Chief Information Security Officers and other stakeholders as a preparation to the new 5G revolution. It can also be used by the BFSI sector and FinTechs to prototype or enhance the discussed use cases.

Smt. Anjana Dube, Deputy Director General, Department of Financial Services, Ministry of Finance, Govt. of India released the White Paper on April 12, 2019.

Handbook on APIs

Everything that goes into making a bank digital like delivering new customer experience, building software ecosystem and moving to multi-cloud environment involves APIs. APIs (Application Programming Interfaces) are becoming, if not already become, the de facto standard for building and connecting applications.

Banks have understood that APIs are not just integration technology to connect applications and data but as software products that empower developers to unlock new digital business models and opportunities. Indeed, the adoption, design, and management of APIs are increasingly driven not by IT middleware requirements but by strategic business goals relevant to senior and top level management of banks. Moreover, Open Banking relies heavily on APIs. It is threatening long-established banking practices and procedures. And banks are converting the threat into a great opportunity.

It is in this background the Institute has attempted to put together all relevant information on APIs in this handbook. This handbook, expected to serve as a good reference material for banks and software companies that are working with banks in development of APIs, was released on August 20, 2019 during the CISO Forum meeting.

Staff Paper Series on FinTech

Banks and FinTechs have started collaborating closely, paving the way for innovative banking products and services. An entire ecosystem led by regulators as well as both central and state governments has been evolving. The ecosystem comprises academic institutions, incubators, accelerators, start-ups, major IT companies and funding institutions.

Some of the major areas in which FinTechs have been working include payment systems, mobile banking, analytics, artificial intelligence, cyber security, customer interface, risk management and blockchain technology. The Institute’s researchers are studying these areas. Given the evolving FinTech ecosystem, we have put together the research studies undertaken by the Institute in the areas relevant to FinTechs.

The Staff Paper Series as FinTech covers the areas of Artificial Intelligence, Blockchain, Security and Financial Inclusion, encapsulating the present status of academic work in the concerned areas along with opportunities for FinTechs to exploit them. The Staff Paper Series on FinTech was released during the Fourth FinTech Forum Meet, held on August 05, 2019.
Project Trainees 2019

The IDRBT Project Trainee Scheme is an avenue for bright youngsters pursuing their Graduation and Post Graduation from premier institutions to carry out projects on various aspects of Banking Technology. This scheme provides an ideal opportunity for students to turn their ideas into action and get acquainted to the niche area of Banking Technology. In the last ten years, over 350 students have carried out such projects. In the summer of 2019, 21 students carried out some very interesting projects, the details of which are presented below:

APIs for QR Code based Merchant Payments

Sreyans Singhi  
B.Tech (IT), Second Year  
IIIT Bhubaneswar  
Guide: Dr. V. N. Sastry

Project Description

This project is on development of APIs and QR Codes for different modes of payments. The project is about the APIs used by each entity to carry out each mode of transaction. The project also focuses on the development of the QR Codes for various modes of payments and combining the QR Codes of various modes to have a single QR Code that contains all the required information. We have also discussed about adapting to various shapes of QR Codes and the data format used for transferring of data from one entity to other.

Objectives

- To develop APIs and QR Codes for each mode of transaction like IMPS, UPI, NEFT and AePS
- To design the request and the response for each mode of transaction and data format used for the transferring of data

Deliverables

- Report on APIs for various modes of transaction, entities involved in each mode of transaction and the data passed between various entities in JSON format
- QR Codes for various modes of transactions and combining the QR Codes of different modes to have a single QR Code for all payment system
- APIs for each mode of transaction like IMPS, UPI, NEFT, AePS
- Prediction Error Expansion based Reversible Data Hiding

Multi-Lingual Voice based Mobile Banking

Utkarsh Jaiswal  
B.Tech (ECE), Second Year  
IIT Guwahati  
Guide: Dr. V. N. Sastry

Project Description

Voice-based instructions in native language is convenient for people compared to any text language typing, particularly on mobile phones. Language translation, machine readability and conversion from text-to-voice and vice versa are emerging automation technologies. The project focuses on study of Indian Language translation standards and usage of appropriate tools for mobile financial services. It involves analyzing popular voice based mobile apps such as Alexa, Siri, Cortana, Google Assistant/Duo, Amazon Music, Tidal, I-Tunes, Bixby, Plex, Discord, etc., and design of APIs for Indian requirements of language translation and execution of verbal instructions for mobile financial services.
Objective

Development of a prototype to demonstrate the voice-based instruction for mobile banking and financial services.

Deliverables

A report on:

- The analysis of Indian Language Translation standards
- Analysis of procedures and tools for conversion of text-to-voice and voice-to-text
- Specification of APIs for these tasks.

R-User Interface for Banking Analytics

Aishwarya Priyadarshini  
B.Tech (CSE), Second Year  
IIIT Bhubaneswar  
Guide: Dr. V. Ravi

Abhisek Sahoo  
B.Tech (CSE), Third Year  
IIIT Bhubaneswar  
Guide: Dr. V. Ravi

Project Description

In this project, we developed an UI for bankers using modern JavaScript framework AngularJS and Node JS. We have worked towards fixing the bugs in the existing web application RUIBA 3.0 and implemented enhancements that have significantly improved database connectivity & web functionality. This application can be used to solve daily business problems and it consists of functionalities that include data pre-processing & partitioning, classification, clustering, regression, time-series analysis, transactional analysis and text mining.

Objectives

To develop a GUI based application that satisfies following requirements:

- Develop better GUI for Banking Analytics
- Easy Data retrieval from Oracle database & analysis of dataset using machine learning models
- Simple to do text-mining and easy visualization.

Deliverables

We developed a web application that provides us with the following facilities:

- User Interface to easily operate the application without any coding
- Taking input files (.csv or .txt) from local directory

Sentiment Analysis and Conjoint Analysis to Rank Products

Aishwarya Priyadarshini  
B.Tech (CSE), Second Year  
IIIT Bhubaneswar  
Guide: Dr. V. Ravi

Project Description

In this project, we first learned the concepts of Sentiment Analysis and Conjoint Analysis, which were then hybridized to propose a new method to rank various products based on the customer reviews.

Objective

To rank the products based on a dataset of online customer reviews by using a hybrid of Sentiment Analysis and Conjoint Analysis
Delivrables

- A software that can perform both Sentiment Analysis and Conjoint
- Analysis to rank various products based on the customer reviews
- A research paper.

Novel Deep Learning Algorithm for Banking Technology

Amiya Ranjan Mallik
B.Tech (CSE), Third Year
IIIT Bhubaneswar
Guide: Dr. V. Ravi

Project Description

Image Cheque detection is one of the most important problems in automatic processing of cheque. We are using object detection technique to detect the cheque entity. Yolo, one of the most efficient algorithm to detect the cheque entity; detects and creates a bounding box around the entity. So we can easily extract the text from the bounding boxes.

Objectives

To automate the cheque detection process that:
- Provides images to directly extract the important field from the cheque images
- Can detect printed text and can save to the file
- Can deal with any type of cheque.

Deliverables

- Designing and implementation of Yolo model using Keras and Tensorflow in python
- Designing and implementing of text recognition system using Tesseract-Ocr.

Ensemble Hybrid Deep Learning Architectures

Jalaj Harkawat
Integrated M.Sc (Mathematics and Computing), Third Year
IIT, Kharagpur
Guide: Dr. V. Ravi

Project Description

In this project, we used the architecture of Restricted Boltzmann Machine (RBMs) to build a Deep Belief Network (DBN), which in turn is used to build hybrid deep learning models. We have used certain models to build an ensemble model using majority voting principle to predict the credit card defaulters.

Objective

To classify the defaulters from non-defaulters on an online dataset of Credit Card Defaulters.

Deliverable

Software and research paper.

Banking Chatbot Development for Android Smart Phones using Deep Learning

Janmejoy Sahoo
B.Tech (IT), Third Year
IIIT Bhubaneswar
Guide: Dr. V. Ravi

Project Description

In this study, we have developed an Android-based application that functions as a Chatbot. It acts as a virtual assistant providing information about all the products of banks as well as handles general queries related to banking. This project is primarily on voice-enabled question-answering systems backed...
by intelligence in the form of deep learning, which will learn from previous conversations held using deep learning architectures. We also developed a Chatbot for IDRBT to guide users to contact the correct department according to their need.

**Objectives**

To develop a Chatbot that caters to the following needs:

- Provides an instant response to any query
- Provides user-specific response at any point
- Remembers the context of the conversation
- Remembers the basic details like name, age, address, etc., that is entered earlier by the user.

**Deliverables**

- A detailed report on RASA (an open source machine learning framework for building contextual AI assistants and chatbots)
- Designing and implementation of API for chatbot to interact with other services
- Designing and implementing an API for Android Application to connect with chatbot running on a server
- Voice integration with the app to convert speech to text.

**IISR: IDRBT IoT Secure Router**

Vibhor Tyagi  
B.Tech (CSE), Third Year  
NIT, Agartala  
**Guide:** Dr. B. M. Mehtre

**Project Description**

This project focusses mainly on IoT network environments, which are generally deployed in smart homes. We have deployed the testbed for this project at CCS Lab, IDRBT. The IISR (IDRBT IoT Secure Router) is a Raspberry Pi 3 Model B+ and five IoT devices are connected to it. We study the behaviour of IISR and IoT devices under attacks, security flaws and privacy protection issues.

IISR is a low-cost and power efficient solution for small networks and is immune to a large number of small attacks, which can further pave the way for preventing many bigger IoT attacks. IISR consists of a Raspberry Pi 3 Model B+, five IoT devices and an attacker machine.

**Objectives**

To develop a low-cost, power efficient, and low-processing power IoT security router, which can be used to secure IoT devices in small scale IoT networks, especially domestic IoT networks, where security is often overlooked.

**Deliverables**

- IISR testbed deployed in CCS Lab, IDRBT
- A project report titled “IISR: A Secure Router for IoT Networks” explaining the various attacks, their detection, prevention and mitigation.

**IISR: IDRBT IoT Secure Router**

Aneesh Dua  
B.Tech, Second Year  
Vellore Institute of Technology, Chennai  
**Guide:** Dr. B. M. Mehtre

**Project Description**

The Internet of Things (IoT) has made the world more convenient and efficient. While the benefits of IoT devices are undeniable, the devices are vulnerable to security threats. Currently, there is no one-step solution for securing the plethora of available IoT devices. Hence, this study is focussed on the development of a security router, which
would be the primary node for IoT devices and could detect and mitigate attacks from hackers.

**Objectives**

- To analyze the methods of attacks on IoT devices and networks.
- To develop a low power router for securing IoT devices.

**Deliverables**

- A low power solution for IoT networks.
- This work tackles attacks against Confidentiality, Integrity, and Availability of connected IoT devices.

**RPL Attacks and Mitigation Methods**

**P. S. Nandhini**  
Asst. Professor, Dept. of Computer Science & Engg.  
Kongu Engg. College, Erode (TN)  
*Guide: Dr. B. M. Mehtre*

**Project Description**

In this project, various RPL based attacks are analyzed and classified into two broad classes of attacks: Address Based and DAG inherited attacks. Each class consists of seven attacks. Using Cooja Simulator, Flood attack and Black hole attack from Address Based Attack class and Version attack from DAG Inherited attack class are simulated and the power consumption analysis of each device is analyzed. The power of the mote decreases rapidly due to overhead of control packets generated by the attacker. The mitigation methods for the corresponding attack are also studied.

**Objectives**

- To study RPL protocol and its vulnerabilities
- To review the possible attacks and their mitigation methods in RPL based IoT
- To implement Flood attack, Version attack and Black hole attack using Cooja Simulator.

**Deliverables**

- Research Report
- Privacy Preserving Public Auditing with Data Deduplication in Fog to Cloud based IoT.

**A Multi-instance Iris Recognition System**

**Veldandi Sowmya**  
Integrated M.Tech. (IT), IVth Year  
IIITM, Gwalior  
*Guide: Dr. M. V. N. K. Prasad*

**Project Description**

Multi-biometric systems use information from multiple sources to provide better recognition of a person than unimodal biometric systems. Multi-instance systems integrate information present from multiple units of a single biometric trait. Fusion of information can be performed at different levels, among them, fusion at feature level combines richer information. Thus, it results in better recognition accuracy.

**Objective**

To investigate existing feature level fusion methods, CCA and DCA.

**Deliverable**

Comparison of existing feature level fusion techniques using different classifiers.
Detection of Vulnerabilities in Apps without Source Code

Aishee Sen
B.Tech (CSE), Third Year
IIEST, Shibpur
Guide: Dr. N. P. Dhavale

Project Description

With the rapidly increasing advancements in digital technology, the threat of illegal repackaging and duplication of android applications is on the rise. It is quite easy to obtain the source code of an APK file using reverse engineering tools like dex2jar and jdgui. Reverse engineering can be used by malicious users to tamper the software and bypass licensing restrictions, or by competitors to extract proprietary algorithms and data structures. Hence, it is essential to protect an application against reverse engineering.

This is where code obfuscation comes in. However, code obfuscation makes it difficult to perform static analyses of apps, and the source code cannot be easily understood as well. Hence, we also require code deobfuscation methods to comprehend the source code.

Objectives

- Understand how reverse engineering works, and how it can be avoided
- Test some Android applications to understand how the testing process takes place
- To find different code obfuscation methods and tools, and understand how they work
- To find possible methods and tools for code de-obfuscation.

Deliverables

- A literature review on different tools and methods for code obfuscation and de-obfuscation
- Test results of some reverse engineering, code obfuscation and de-obfuscation tools.

Survey of UPI apps for Usability and Security Guide

Arjun Basu
B.Tech (IT), Third Year
IIEST, Shibpur
Guide: Dr. N. P. Dhavale

Project Description

The user reviews of the app on Google Playstore provide a plethora of information regarding the usability of an app, covering a wide range of test cases. During the course of the project, the reviews of various UPI apps have been analyzed and various Data Mining and Natural Language Processing Techniques have been applied on them, to obtain certain usability attributes of the application under scrutiny from the reviews.

Objectives

- Collection of User Reviews of various UPI apps
- Normalization & Pre-processing of the data
- Fitting the dataset to various models
- Comparison, Analysis and Validation of the results obtained.

Deliverables

- Implementation code
- Dataset containing the user reviews scraped from the web
- Executable for the purpose of data-labelling
- A technical report containing the methodology and results.
Building Use Cases for Bank App Vulnerabilities and Development of Bank App for Securing Messages using Signing and Encryption

Mohd. Aliasgar Chikhaliwala  
B.Tech (IT), Second Year  
IIEST, Shibpur  
Guide: Dr. N. P. Dhavale

Project Description

Bank Apps are becoming popular for transactions and its security is very important. The project aims to build use cases to demonstrate and mitigate vulnerabilities in apps in general and in bank apps, in particular. It also focuses on methods to secure Messages in Banking Transactions using Signing and various Encryption Techniques.

Objectives

✦ To study the vulnerabilities in mobile applications, specifically banking applications and build use cases for those vulnerabilities, implement various methods for mobile app penetration testing
✦ To study encryption techniques and develop an android application to demonstrate the securing of messages in banking application using signing and encryption.

Deliverable

An Android Application to demonstrate common vulnerabilities in mobile banking application.

DIY Open Source Intelligence – OSINT Collection

Sai Shashank Bandela  
Int. M.Tech. (CSE), 4th Year  
University of Hyderabad  
Guide: Dr. V. Radha

Project Description

Every year, thousands of people lose money to telephone scams. Scammers may call you claiming to work for a company you trust and ask for personal information such as bank account details, user login credentials, OTPs, etc.; or worst a customer may themselves call a wrong phone number listed on a website. The Wall Street Journal performed an investigation where it claims that around 11 million businesses listed on Google Maps are false, and estimates thousands are being added every month. So work must be done on combating these false listings.

Objective

This project is aimed at reporting those websites that have false mobile numbers and also other communication details such as email ID.

Deliverables

Implementation of the false listings by integrating Scumblr and Sketchy (open source tools by Netflix).
Prediction Error Expansion based Reversible Data Hiding

Sweta Kabi  
B.Tech (ETC), Third Year  
IIIT Bhubaneswar  
**Guide:** Dr. Rajarshi Pal

**Project Description**
Reversible data hiding is a special kind of data hiding technique, where the cover media can be restored alongside extraction of the secret data. A novel reversible data hiding technique has been proposed in this report using a quad-tree decomposition based prediction of image pixels. The superiority of a Prediction Error Expansion (PEE) based reversible data hiding scheme depends on a good prediction strategy for image pixels. In the proposed scheme, the quad-tree decomposition is used to recursively decompose the image into a set of squares. The vertices of such squares serve as the reference pixels to predict the intensity values of other non-reference pixels within the square. Data bits are reversibly embedded into these non-reference pixels by expanding the prediction error.

**Objectives**
To build an efficient method, which predicts image pixel values based upon prediction error with respect to original image, reversibly hide and extract secret message bits from the image.

**Deliverable**
A technique, which efficiently embeds data reversibly in images and also extracts it faster than the existing methods.

Gaze Based Graphical Password System

Baibhav Kumar  
B.Tech. (ETC), Third Year  
IIIT Bhubaneswar  
**Guide:** Dr. Rajarshi Pal

**Project Description**
The aim of this study is to develop an Eye–Gaze Based Graphical password system. In this password scheme, I am using a layered combination of graphical elements. It has unique capabilities in terms of low memory burden due to approach of shapes, colours and alphabets while at the same time being very resistant to shoulder surfing threats and Brute Force Attack. A colour and a shape are two different things that humans can easily distinguish. At the time of authentication, the system takes the user’s input about his password option (one out of Shape, Colour and Alphabet) for each window out of 4 windows. He will be shown some images from dataset according to his preferred option. At the time of authentication, he needs to recall it and look at the chosen passcode appearing in a display in correct sequence. The method uses a deep learning technique, where a convolutional neural network is used to determine gaze locations using inputs from a simple web camera. The web camera takes cropped eye as input and provides gaze location as output.

**Objective**
To build a convolutional neural network model which can understand the location of eye-gaze for different users and a user-friendly interface for a gaze-based graphical password system.

**Deliverables**
+ A prototype for a gaze-based graphical password system
+ A Research Paper.
Optimal Energy Aware Dynamic Virtual Machine Consolidation in Cloud Datacenters

Reeti Kamal Sandeep
Integrated M.Tech (IT), 4th Year
IIITM Gwalior
Guide: Dr. P. Syam Kumar

Project Description
In this project, we proposed Optimal Energy Aware Dynamic Virtual Machine consolidation by using new VM selection called MCSSD (Maximum Correlation of Sum of Squares from Mean Deviation) of OLS regression. We implemented this by using CloudSim Toolkit for simulation of Cloud datacenter environment. The experimental results show that our VM selection policy is consuming lesser energy than other VM selection policies.

Objectives
- To decrease energy consumption of Cloud Datacenters
- To decrease number of VM migrations during simulation
- To achieve better utilization of resources of Cloud Datacenters.

Deliverable
The proposed VM consolidation approach can be used in bank datacenters to reduce the energy consumption and increase resource utilization.

Privacy Preserving Public Auditing with Data Deduplication in Fog to Cloud based IoT

Ruchi Saha
Int. M.Tech. (CSE), 4th Year
IIITDM, Kancheepuram
Guide: Dr. P. Syam Kumar

Project Description
In Fog computing environment, IoT devices are connected to Fog devices. The Fog devices are located in close proximity to users and are responsible for intermediate computation and storage, hence reducing communication time for low latency IoT devices. Although this new technology conveniently resolves latency issues, it needs to address two essential challenges: detecting duplicate data and auditing integrity of the data in cloud to increase the confidence of the users.

Objectives
- Public Auditing
- Block less Verification and Privacy Preserving
- Auditing Soundness
- Deduplication of cloud data
- Proof of Ownership
- Efficiency.

Deliverable: This scheme is useful for IoT based banking applications.
Lightweight Certificateless Privacy-Preserving Public Auditing Cloud-based IIoT

**Project Description**

The Industrial Internet of Things (IIoT) is the use of smart sensors and actuators to enhance manufacturing, industrial and banking processes. With the continuous development of the IIoT, many organizations/banks choose cloud for storing the data, which is collected by IoT devices on a cloud server for saving costs. However, since the cloud is untrusted, to ensure the integrity of data stored in the cloud, we proposed and developed a lightweight certificate less privacy-preserving public auditing scheme. The basic idea of our scheme is that the user generates Lightweight Certificate less Signature and sends it to the Cloud that can be verified by third-party auditor, who can do Public Auditing for Data Integrity. During Auditing process, data privacy is preserved. Finally, the security of our scheme is proved under the CDH assumption in the random oracle model.

**Objectives**

- To achieve Public Auditing of data by a TPA that checks the correctness of the information kept in the cloud without downloading the whole information or causing extra burden to the IoT Device
- To create a lightweight Tag for IoT device as it would be less computation intensive
- To preserve the privacy of data sent to third party auditor, who cannot access the data while auditing to prevent the scenario for data breach.

**Deliverable**

- Banking Sector can use IIoT Infrastructure as a new way of secure banking. These lightweight machines can bring new use cases of IoT for faster banking. Data generated by these devices will be stored on Cloud, which would be verified by Third Party Auditor for data integrity
- With such a secure low-cost device, large scale implementation will be very easy.

Programmable RAN Slicing using Wi-Fi for Exclusive Usage by Banks

**Project Description**

Using SDN, this project demonstrates the ability to slice the Wi-Fi bandwidth for multiple closed user groups. It involves setting up of two access points and controlling them to demonstrate that the reserved slices for banking usage is not impacted by overload at the Wi-Fi access points. The project will also explore higher QoS for a specific slice.

**Objectives**

- Study the concepts and different open source tools related to network slicing
- Implement networking using SDN and other tools over wired as well as wireless connections.

**Deliverables**

- Setup instruction for access points and control software
- Project report.
## Executive Education Programmes (January to March 2020)

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Data Centre Management</td>
<td>06-08</td>
<td>Dr. P. Syam Kumar</td>
</tr>
<tr>
<td>02</td>
<td>Cyber Defence for Banks</td>
<td>06-10</td>
<td>Dr. Rajarshi Pal</td>
</tr>
<tr>
<td>03</td>
<td>Workshop on Registration Authority Operations</td>
<td>20-21</td>
<td>Dr. N. P. Dhavale</td>
</tr>
<tr>
<td>04</td>
<td>Secure Coding Practices</td>
<td>20-24</td>
<td>Dr. V. Radha</td>
</tr>
<tr>
<td>05</td>
<td>Data Science in Banking and Finance</td>
<td>29-31</td>
<td>Dr. Mridula Verma</td>
</tr>
</tbody>
</table>

**FEBRUARY 2020**

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>Banking Technologies</td>
<td>03-07</td>
<td>Dr. Rajarshi Pal</td>
</tr>
<tr>
<td>07</td>
<td>Programme on DevOps</td>
<td>03-07</td>
<td>Dr. P. Syam Kumar</td>
</tr>
<tr>
<td>08</td>
<td>IT Operational Risk Management</td>
<td>10-12</td>
<td>Dr. N. P. Dhavale</td>
</tr>
<tr>
<td>09</td>
<td>Early Warning Systems with Analytics</td>
<td>10-12</td>
<td>Dr. V. Ravi</td>
</tr>
<tr>
<td>10</td>
<td>Software Defined Networks</td>
<td>10-12</td>
<td>Dr. V. Radha</td>
</tr>
<tr>
<td>11</td>
<td>Banking Application – Lifecycle Management</td>
<td>17-19</td>
<td>Dr. Abhishek Thakur</td>
</tr>
<tr>
<td>12</td>
<td>Payment Systems - Current Trends and New Initiatives</td>
<td>17-19</td>
<td>Dr. N. V. Narendra Kumar</td>
</tr>
<tr>
<td>13</td>
<td>Technologies for Financial Inclusion</td>
<td>24-26</td>
<td>Dr. M. V. N. K. Prasad</td>
</tr>
<tr>
<td>14</td>
<td>API Development</td>
<td>24-28</td>
<td>Dr. V. Radha</td>
</tr>
</tbody>
</table>

**MARCH 2020**

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Website Security</td>
<td>02-04</td>
<td>Dr. Rajarshi Pal</td>
</tr>
<tr>
<td>16</td>
<td>IT Project Management</td>
<td>02-04</td>
<td>Dr. Abhishek Thakur</td>
</tr>
<tr>
<td>17</td>
<td>Business through Analytics</td>
<td>16-18</td>
<td>Dr. V. Ravi</td>
</tr>
<tr>
<td>18</td>
<td>Security Operations Centre</td>
<td>23-27</td>
<td>Dr. V. Radha</td>
</tr>
<tr>
<td>19</td>
<td>Information Systems Control and Audit</td>
<td>23-27</td>
<td>Dr. M. V. Sivakumaran</td>
</tr>
</tbody>
</table>

## Certification Programmes (January to March 2020)

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>IT and Cyber Security for Senior Management</td>
<td>09-10</td>
<td>Dr. V. Radha</td>
</tr>
<tr>
<td>02</td>
<td>IT and Cyber Security for Senior Management</td>
<td>23-24</td>
<td>Dr. N. P. Dhavale</td>
</tr>
</tbody>
</table>

**FEBRUARY 2020**

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>IT and Cyber Security for Board Members</td>
<td>03-04</td>
<td>Dr. N. V. Narendra Kumar</td>
</tr>
<tr>
<td>04</td>
<td>IT and Cyber Security for Senior Management</td>
<td>05-06</td>
<td>Dr. M. V. N. K. Prasad</td>
</tr>
<tr>
<td>05</td>
<td>IT and Cyber Security for Senior Management</td>
<td>17-18</td>
<td>Dr. N. V. Narendra Kumar</td>
</tr>
<tr>
<td>06</td>
<td>IT and Cyber Security for Senior Management</td>
<td>27-28</td>
<td>Dr. Abhishek Thakur</td>
</tr>
</tbody>
</table>

**MARCH 2020**

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Date</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>IT and Cyber Security for CXOs</td>
<td>02-06</td>
<td>Dr. Rajarshi Pal</td>
</tr>
<tr>
<td>08</td>
<td>IT and Cyber Security for Board Members</td>
<td>05-06</td>
<td>Dr. Abhishek Thakur</td>
</tr>
<tr>
<td>09</td>
<td>IT and Cyber Security for Senior Management</td>
<td>12-13</td>
<td>Dr. B. M. Mehtre</td>
</tr>
</tbody>
</table>

For details, please write to program@idrbt.ac.in or visit www.idrbt.ac.in
Institute for Development and Research in Banking Technology
(Established by Reserve Bank of India)
Castle Hills, Road No. 1, Masab Tank, Hyderabad – 500 057, India.
+91 – 40 – 2329 4999, +91 – 40 – 23535157
www.idrbit.ac.in publisher@idrbit.ac.in