Minutes of the Meeting (2) of the Project Review & Steering Group for the Project "Distributed Centre of Excellence for Blockchain Technology"

1. Meeting (2) of the Project Review & Steering Group (PRSG) for the project "Distributed Centre of Excellence for Blockchain Technology" was held on 1ˢᵗ May 2019 at C-DAC Hyderabad.
   List of persons who attended the meeting is at **Annexure I**.

   1.1. Shri Magesh, Chief Investigator of the project briefed about the project efforts till date. He informed that, for the property record management application, the team is closely interacting with Telangana state government and with their support pull based web services is enabled in existing application. This has resulted in successfully populating near real time transactions into Blockchain. He requested the PRSG to guide the team in effectively taking the efforts to the end-users.

   1.2. Shri Tarun Pandey, the Member-Convener, welcomed the members and briefed the PRSG about the project objectives, deliverables, project duration and mentioned that the project is being executed jointly by C-DAC Hyderabad, IDRBT Hyderabad and VJTI Mumbai. He mentioned that the duration of the project is 2 years starting from 15ᵗʰ March 2018. The total outlay of the project is Rs. 643.07 Lakhs. A total amount of ₹ 339.10 Lakhs has been released towards first year funds to the project: C-DAC (₹ 249.80 Lakhs), IDRBT (₹ 39.30 Lakhs) and VJTI (₹ 50 Lakhs). He mentioned that first year fund is completely released to all the organizations except for Rs. 9 Lakhs to VJTI, Mumbai. He asked the project team to present the details against each of the objectives and also about the action taken on the recommendations of first PRSG meeting.

   1.3. Prof. Veni Madhavan, Chairman of the PRSG, in his opening remarks highlighted the importance of project. Referring to the pilot / proof of concept (PoC) implementations undertaken in the current scope of the project, he advised the team to identify other potential use cases which can be implemented using Blockchain Technology in future. He suggested the team to mention the details of linkage across organizations and also the kind of research challenges being addressed.

   1.4. Smt. L Rama Devi, OSD, ITE&C Dept, Telangana Government brought out the initiatives of Telangana State Government in the emerging technologies. Explaining the Blockchain technology use cases identified by them, she mentioned about the support being extended by the state Government, specifically the IT department and the domain expertise from Registration department, for the development and pilot implementation of Property record management application to C-DAC Hyd team. She expressed that looking at the dedication of C-DAC team and their technical capabilities, she is confident that pilot implementation would be successfully completed at the earliest with the support from State Government. She also highlighted other PoCs identified by State Government: (a) issuing SSC

certificates to the students, (b) Dwakra loan tracking application under micro finance area, (c) fake drug detection. She further mentioned that the project Dharani taken up by the State Government for agricultural lands has planned for Blockchain implementation in later phases and this early implementation of solution would provide better inputs for further enhancing and scaling the planned system.

1.5. Minutes of the meeting (1) of the PRSG held on 20th Sep 2018 were circulated to the members. Since no comments were received from the members, the minutes of meeting (1) were confirmed.

2. Deliberations

C-DAC Hyderabad, IDRBT Hyderabad and VJTI Mumbai teams made a presentation explaining the objectives, deliverables, proposed approach, technical details, overall status, manpower deployment and funds released & utilized. The following were brought out during the presentation and discussions:

2.1   Technical

2.1.1 Objectives

The team explained that the overall objectives of the project are: (1) Evolving an ecosystem around R&D organizations, Government departments and Academia to foster Blockchain technology, (2) Design, development and pilot deployment / prototyping of Blockchain based applications in the domains of Governance, Banking & Finance and Cyber Security, (3) Conduct research to address the issues and challenges related to Blockchain usage in identified application domains, (4) Evolving Blockchain framework using open-source implementations to suite the identified application domain requirements and (5) Capacity building in Blockchain technology.

2.1.2   Distributed Centre of Excellence - Overall Efforts

The team explained the project efforts in line with the objectives of the proposal on "Distributed Centre of Excellence on Blockchain Technology" and also linkage across the organizations.

Objective 1 Ecosystem: is built around C-DAC, IDRBT and VJTI complementing each other efforts. Research activities, pilot / PoC implementations and capacity building efforts are taken up in an integrated manner.
Objective 2 Pilot / PoC implementations: C-DAC Hyderabad is focusing on pilot deployment of property record management and prototyping cloud security assurance solution under Governance and Cyber Security domains. IDRBT is designing and developing trade finance and Centralized Know Your Customer (CKYC) applications under finance domain. C-DAC team is working with IDRBT for the possibility of integrating CKYC in Property Record Management Application.

Objective 3 Conduct research to address the issues and challenges: Chief Investigator from all the three organizations informed that they are involved in carrying the research to address the issues and challenges related to Blockchain Technology and its implementation in different application domains. Technical publications and reports are being generated.

Objective 4 Blockchain Framework: IDRBT Hyderabad is working towards design & development of Blockchain platform considering the requirements of financial applications. C-DAC Hyderabad is also making enhancements (PoE REST APIs support) to open source BCT platform suitable for different application scenarios.

Objective 5: Capacity Building: The CI's of the three organizations informed PRSG that they are actively contributing to various capacity building programmes such as conduction of workshops, seminars, skill based trainings etc. VJTI is also focusing on faculty development programs, finishing schools and also guiding projects in B.Tech & M.Tech and PhD programmes in Blockchain Technology. All the three organizations are involved in courseware preparation.

The Telangana Government is supporting C-DAC Hyderabad team by providing domain expertise towards design and development of property record management system (registration system) using Blockchain Technology and pilot deployment of the application in Shamshabad registration department.

2.1.3 Summary of Action taken on the recommendations of the PRSG in its earlier Meetings

- The PRSG in the earlier meeting recommended the inclusion of use case scenarios related to disputed / benami property while demonstrating the property record management application. The team explained that as per the workflow adopted by the Telangana Govt, there is a separate database of disputed property cases and before registering any property it would be verified with this database. Regarding inclusion of benami cases, the team explained that in the current practice, the required financial details including bank details are not captured in the existing registration application workflow implemented by the State Government. Hence, it is felt that without these details, addressing benami property issues would not be possible in the present Blockchain implementation.

- Regarding the PRSG recommendation to carryout scalability testing on the developed property record management application, the team mentioned that they have carried out the scalability testing and found that the throughput recorded in test environment is 10 transactions per second (tps) with send rate ranging from 10 tps to 50 tps. This is much higher than the throughput that may be required (calculated at 0.15 tps) in the actual scenario.

- As per the PRSG recommendation, IDRBT has sent a request letter to MeitY for permission to replace the deliverable "Report on Central Bank Digital Currency" with "Report on Managing Digital Assets using Blockchain".

- As recommended by PRSG for taking up Government officials training by VJTI, the team informed that VJTI has planned for a training program for Government officials in the month of June 2019.

- As per the recommendation of the PRSG to submit a project worksheet containing the activities that were carried out in the project in-line with the objectives of the project of VJTI, the team has mentioned that they have submitted the detailed report of the activities.

- As suggested by the PRSG to provide a world-comparison of BC technology, the team mentioned that they have prepared a report with global and national scenario.

2.1.4 Project Efforts

2.1.4.1 C-DAC, Hyderabad

Pilot implementation of Property Record Management System

The team mentioned that the overall activities involved in the pilot implementation are (a) Understand the workflow of the existing Telangana state application (b) survey on the existing blockchain platforms (c) identifying the suitable blockchain platform (d) design and development of the application (e) Identification of one district for the pilot implementation (f) migration of the existing data of the identified district to the blockchain (g) capturing the live data being generated at the sub registration office (SRO) of the identified district (h) demonstration of the developed application and (i) testing the developed application.

The details of the overall activities are as follows:

(a) Understanding Application Workflow:

Team has mentioned that they have attended several meetings with Telangana State Government to gain the domain knowledge, understand the workflow and identify the possible integration hooks with the existing system. State Government has supported the team to document the workflow being followed.

Workflow includes four important steps: a) Pre-processing of the data b) Check slip report generation c) Collecting fingerprints, signatures, photos & endorsing the details on the registration document and d) Generation of the final regular document with a digital signature. Among these steps it was found that two important transactions are crucial and are required to be recorded on the Blockchain, which includes i) Checkslip generation and ii) Regular document generation. Based on this, the team evolved the approach in implementing the property record management system using Blockchain and mentioned that during registration process in the existing application, details are stored in the database at two phases (check slip report generation and final regular document generation).

(b) Survey of the blockchain platforms:

Team has surveyed 17 open source platforms considering the parameters namely type of platform (such as permissioned / non-permissioned), licensing (open source / commercial), support ecosystem (community / industry), platform activeness in terms of release frequency and performance characteristics.

(c) Identifying the suitable platform:

One of the requirements for Property Record Management System is identification of suitable Blockchain (BCT) platform for development efforts. Based on the survey, Hyperledger platform is selected for Property Record Management system as the application requires BCT platform which is permissioned & private, open source & active, widely used, reasonably large development community with industry and academia support. Further it supports smart contracts, exposes the platform functionality via SDK, has a pluggable consensus algorithms with approximately two transactions per minute as per the requirements derived from inputs given by Telangana Government.

(d) Design and development of the application:

The team explained that the application stack implemented by them has 4 layers. Layer 1 is the network, channel and smart contracts at Layer 2, REST server at Layer 3 and UI for PM App at Layer 4.

The team has presented the layer 1, network setup details. They mentioned that the setup has 3 organizations namely Revenue who is responsible for mutation records after registration, Survey and Settlement department responsible for allotting the survey numbers & Stamps and Registration responsible for registering the documents. Every organization has 2 peers and the entirenetwork has one orderer.

The PRSG suggested to change the setup from Ubuntu to CentOS as Ubuntu is normally used for carrying out the development work and CentOS is preferred for the production setup. The team mentioned that they will shift the setup to CentOS soon.

When PRSG enquired about the orderer type, the team mentioned that though the setup is on multi node, still the Solo configuration is being maintained for the orderer. The team also mentioned that migrating from Solo to Kafka is in the list of the future activities by the team.

The team further mentioned that the Blockchain network includes multiple actors like peers, orderers, client applications, administrator etc. Each of these actors should have the digital identity encapsulated in an x.509 digital certificate to use the services of the BCT network. These digital certificates regulate the exact permissions over resources and access to information that actors have in a blockchain network. Membership Service Provider (MSP) is used to build the trust across all the actors in blockchain network.

The team continued presenting the details of layer 2, channel and smartcontract. Team mentioned that *pmbctchannel* is for the organizations participating on the metadata of the Property record management application and *pmpoechannel* is for the organizations participating on the hash of the registration document. Smart contract helps as a medium to talk to the network from the application. Smart contract handles the two transaction details (checkslip generation and regular document generation) and the search functionality on the blockchain. The smart contract also carries out validation of inputs coming from the application, before recording it on the Blockchain. Smart contract is implemented to accept generic JSON and record the data on hyperleger fabric blockchain for checkslip and regular document transactions. Smart contract is associated with an Endorsement policy at the time of instantiation and the default endorsement policy is "Any member of the organizations in the channel can endorse the transaction".

Team has presented the details of layer 3, REST server which is an architectural pattern & an industry practice for exposing functionality to applications. This layer provides a REST API interface to register Users on the Blockchain Platform (including public / private key generation), Channel creation, joining peers to channel, installing chaincode, instantiate chaincode, Recording existing properties, check slip data & Transfer of property in Blockchain and getting the property history & Capturing the live data through Web Services (provided by the Telangana State Government) and recording on Blockchain. The team also mentioned that REST APIs are exposed for verifying the ownership details and provide the Encumbrance Search from the Blockchain Application (PM App) to Telangana Land Registration Application. This interface has to be used by the existing application of Telangana State Government.

PRSG committee queried about the authorization details provided at Layer 3, the team mentioned that at every layer role based permissions are enabled. Committee also discussed about the possibility of storing the keys securely and suggested the team to look for a simple mechanism to store the keys securely.

The team mentioned that UI is implemented at layer 4 to interact with the underlying blockchain namely digitizing the property, generating the checkslip report, completing the registration and providing the EC search functionality.

(e) Identification of one district for pilot implementation

The team has mentioned that they had several interactions with Telangana State Government and finally decided to go with Shamshabad district for pilot implementation.

(f) Migration of the existing data of the identified district to the blockchain

(g) Capturing the live data being generated at the sub registration office (SRO) of the identified district

The team explained the PRSG that they had several meetings with the state Government in identifying the fields that are to be stored in the blockchain and also requested to provide the database of the shamshabad district and web services to capture the live registration transactions. The state government has provided the existing database of Shamshabad district and also enabled two web services (one for consuming the details after check slip report is generated and one after the regular document is assigned to the registration document).

The team has mentioned that there are around 72,000 registration records from 2008 to 2018. The team explained the process of identifying a property uniquely using the important attributes of the property. These details are populated to the blockchain along with the details of seller, buyer, witness and property details.

(h) Demonstration of the developed application

The team mentioned that the PoC application mimics the activities performed at the Sub Registrar Office (SRO). The team mentioned that the checkslip and regular document transactions are pushed onto the Blockchain and a provision is made to store the hash of the regular document in the Proof of Existence (PoE) Blockchain. Along with the hash, regular document can be stored in Proof of Storage which is based on Interplanetary File System (IPFS). Team mentioned that, the Blockchain application facilitates in validating the title ownership details during the checkslip report generation phase of registration. The application also helps in providing the encumbrance search by retrieving the details from the immutable Blockchain.

To the query of the PRSG about the type of IPFS used, the team mentioned that it is a private setup in the same environment.

The team further mentioned that the PoC application is implemented as a parallel system to the existing Telangana State Government application so as to harness the advantages of Blockchain technology. In this system, the database of Shamshabad district provided by the state government is migrated to the blockchain. The system captures the near real time transactions performed at the Shamshabad SRO office. The system has the facility for Encumbrance Search which provides the details from 2008 to till date.

When the PRSG queried about the facility given to citizen's portal, the team mentioned that considering the existing state government application, this facility is already implemented through blockchain system at the backend, so as to not create a chaos to the citizens with two citizen's portals. State government has to use this feature in the existing application.

Team summarized the features and benefits of the blockchain implementation. This includes live Blockchain data hooks in the registration phase for early verification, Encumbrance / link document

search, Proof-of-Existence implementation for final registration document wherein validity of the registered document can be established through PoE. Team also mentioned that blockchain implementation can avoid double registrations and insider attacks (database attacks).

(i) Testing the developed application

The team also mentioned that they have carried out the testing. The performance benchmarking of the implemented chaincode is done via Hyperledger Caliper tool with a setup on a single physical machine. The details of the machine has Ubuntu 16.04.6 LTS, 8 core - Intel(R) Core(TM) i7-3770 CPU @ 3.40GHz, 8 GB RAM with 1 Gbps network. Team has mentioned that the developed smart contract handles recordProperty (2888 bytes approx. and one write), *recordCheckslip* (2794 bytes approx., one write), *recordRegularDocument* (2990 bytes approx., one write) and *queryByPropertyId* (86 bytes approx., one read). The team mentioned that the throughput was approx. 10tps for write operations and 12tps for read operations which is far larger than the throughput that may be required in the actual scenario (0.15 transactions per second or 15,32,980 transactions in year for Telangana state government). The PRSG suggested the team to carry out the throughput testing with peak hour data for which the team has agreed to carry out.

Proof of Existence:

The team mentioned that storing the hash of the document with the timestamp in the blockchain which is immutable has a potential in the digital world which proves the temporal existence of the document, verifies the origin, authenticity and integrity of the document. With this motivation, the team has implemented blockchain based Proof of Existence as a Service (PoE as a Service) as a spin off component. This plays an important role for proving the document ownership without revealing actual data and proves that certain data exists at a certain moment of time. This certifies the existence of document without need of Central Authority, ensures document integrity, ensures that the document cannot be tampered retroactively, and complements existing system with extended features like authenticity of document. The team also mentioned that PoE was lunched during the C-DAC's foundation day. C-DAC ACTS Student Certificate application based on Blockchain based PoE is implemented and is going to be rolled out for the current batch.

The team and PRSG further discussed on the hash calculation and suggested the team to study on the process of calculating the hash, to be precise, whether the hash is to be calculated for the asset or the document.

Efforts towards Platform Enhancements

Blockchain platform is enhanced with PoE feature which provides REST API interface for building PoE enabled applications to ramp up the application development. Also integration of PoE and PoS features is ongoing.

Global and National Efforts

Team has explored on the global and national efforts in using Blockchain technology and informed that the technology is being adopted in different countries in Government operations in application domains such as land records & student certificate management, online travel portal, intellectual property rights, tracking royalties for musicians, tracking financial transactions, securing health records and so on. In most of the cases the applications are in pilot implementation except few which have gone to production.

Security Assurance in Cloud Environment

Team presented the details of efforts made towards enabling Security Assurance in Cloud environment using Blockchain Technology. One of the main concerns in using cloud infrastructure is, trusting the third party cloud service providers (CSPs). Currently there is no provision for the user to get an assurance on cloud governance by CSPs in an independently verifiable manner.

The objective focuses on defining a security assurance framework comprising policy rules to be adhered to by the cloud platform. The team presented the major attacks / threats faced by some of the worldwide popular services such as LinkedIn, Yahoo, MongoDB etc. They have explained that the major causes of attacks on these platforms are identified as due to mismanagement of credentials such as weak passwords, malicious insiders, account hijacking, data breaches, Insufficient due diligence, denial of service, shared technology vulnerabilities etc.

The team informed the committee that in view of the above situations they are trying to define a security assurance policy framework in terms of defining rules pertaining to system security related configuration, firewall configuration as per the best practices, user accounts to be used for system level services, access permissions of important files or other resources on any VM, user login access particulars etc. They have also explained that few of the rules have already been implemented and tested on VMs.

The team also explained that they are experimenting with Openstack's security policy framework to capture relevant policy rules from the cloud platform's context so that the expertise can be utilized during prototype development. The team explained that Blockchain is being used as a storage repository for maintaining pre-processed information after collecting the same from logs and other sources on VMs in cloud platform. The reason for using Blockchain is to meet the fundamental requirement of providing an untampered and secured storage for audit trails. This will give the confidence to the investigator or auditor that the information in intact and worth for further processing.

The team informed that they have identified Log stash application for collecting information from logs and other sources from each VM and explored available options such as sending log information through network to the Blockchain network. The team also explained that the pre-processed information from individual VMs will be sent in a standardized JSON format so that retrieval of the same from Blockchain network will be easy based on parameters such as VM identity and timestamp.

The PRSG suggested looking in to the SIEM (Security Information and Event Management) tools which are meant to collect log information from the devices and process the output. The PRSG suggested to interact with companies like Solarwinds and Intelli Talk to see their activities in security domain.

The PRSG queried if the data obtained from logs and other sources from each VM is pre-processed before committing to Blockchain, team mentioned that only the pre-processed data would be stored in Blockchain.

When PRSG committee queried on how the actual or gross root level data in the VM will be maintained. For this the team explained that the gross root level data could be of two types, dynamic such as network statistics where only snapshot can be taken at any given point of time and cannot be produced subsequently and static such as application / system level logs etc. Hence, the team will explore the feasibility of transferring the information generated by the software (logstash maintained as a trusted code) installed on each VM to Blockchain in a secured way using PKI or digital signatures.

The PRSG also advised to give focus on impact on Blockchain platform performance when large pool of information is required to be handled in initiatives of this kind.

Capacity Building

Finally the team has explained their efforts in organizing capacity building activities. It is informed by the team that one out of two skill based training and one out of three workshops/seminars are organized by C-DAC as on date. One more skill based training and two day workshop are being planned in the month of May/June 2019. Apart from this, team members also delivered invited talks on Blockchain in various colleges/Institutions. The team also mentioned that online introductory course on Blockchain Technology was designed launched to C-DAC members as a part of C-DAC Accelerated Knowledge Enhancement Series (CAKES) initiative by C-DAC HRD team.

The PRSG advised the team to circulate the curriculum for the 5-day skill development program for which the team has agreed.

C-DAC team expressed that they are keen to conduct one workshop at MeitY to showcase importance of technology and its use cases to different Government departments. PRSG committee agreed for the same and suggested all three teams to showcase their efforts in the workshop.

2.1.5 IDRBT

IDRBT made a presentation on the technical and financial progress on the project. In particular, the following were covered: (i) details of platform implementation including a demonstration of important cases, (ii) initial efforts towards the design of CKYC solution and the challenges encountered, (iii) preliminary study on the classification of digital assets and (iv) Capacity Building Efforts

The team has mentioned that the platform is being developed in four modules they are consensus service, dataservice, membership service and client proxy. As the Consensus service (CS) is the core of the proposed platform development they have implemented it based on Practical Byzantine Fault Tolerance (PBFT). In PBFT replicas achieve consensus using exchange of messages and state machine replication technique. All the replicas upon receiving necessary certificates progress to a new state. PBFT algorithm requires $3f+1$ nodes, where f is number of failures that a system can tolerate. Here the faulty nodes can be even the nodes which crash during the process.

The team has mentioned that Membership Service provides Authentication and authorization of clients and replicas. Currently client authentication is completed and Public and Private key encryption module addition is on-going.

The team presented proposed datastore model. Data (transaction or block) is stored in a separate data base and data service provides an interface to clients to fetch data from the data base. Currently the requests and responses are being processed using Django Rest APIs and PostgreSQL as data base and Block level storage and integration with consensus service is on-going.

The team has mentioned that a simple web application was developed to interact with consensus service. The functions provided by the interface are (a) Sending requests with request flooding at 500 requests / sec or 1000 requests / sec and (b) Collect $(f+1)$ matching responses, where f is the number of faulty nodes.

The team has explained the efforts towards CKYC implementation. They mentioned that the study of publicly available implementation on CERSAI based approach for CKYC and UIDAI approach for eKYC were explored. So far they have identified the challenges faced by the CERSAI model. Based on the findings, the team is planning to utilize the instant verification of identity approach used in eKYC for the preliminary authentication phase in CKYC design

The team explained about the preliminary approach for classification of assets in digital realm. The team mentioned that the digital assets can comprise of virtual assets (information) or physical assets. These physical assets can of atomic or composite assets. Based on this distinction, they are carrying out their efforts in classification of digital assets. The PRSG suggested to reconsider the classification as composite asset can be of either virtual or physical asset for which the team has agreed.

Under the capacity building activity, the third workshop on Blockchain Technologies & Applications was jointly conducted at IIT Bombay and IDRBT Hyderabad between February 04-07, 2019. Apart from this a document titled "Blueprint of Blockchain Platform for banking sector and beyond" was released in collaboration with multiple stakeholders.

The team mentioned that had published one paper titled "A Comparative Study of Permissioned Blockchain Platforms" by Ravi Kanth Kotha, N. V.Narendra Kumar, and T. Ramakrishnudu at International Workshop on Blockchain Technology, co-located workshop of the 6th International conference on Big Data Analytics 2018 at NIT Warangal (https://easychair.org/cfp/IWBT18).

2.1.6 VJTI

The team mentioned that the objective of VJTI is capacity building which includes (a) Core competency, (b) Courseware (c) Getting training and (d) Imparting training/programs – FDPs (2), Workshops (2), Awareness seminars (2), Hands on training programs (3), Finishing schools (2).

The team mentioned that various activities were carried out to gain the core competency and the ability to apply Blockchain technology in different application domains. Out of which, eight undergraduate project groups of VJTI are exploring different use cases and ten Masters dissertations are taken up in at VJTI Mumbai. VJTI team won the first prize INR 5.00 lacs and Best Public/Jury award for the Project "Micro grid Energy Trading using Blockchain" at Global Blockchain Congress organized by West Bengal Govt. at Kolkata, India (18-19 Dec 2018). As a part of developmental efforts Somechain (based on Proof of Work) and VJTI Blockchain (based of Proof of Authority) are implemented. Somechain is being used in the campus with Canteen and Book store onboard of the application. Tokens are issued to the students if they solve puzzles (proof of work). These tokens are used for buying food at canteen for buying stationary at book store.

The team presented the details of designed and developed Courseware. One Core subject course on Blockchain Technology was designed for MCA/BTech-CS/IT and proposed to academic council for induction at 3rd year level at VJTI Mumbai. Interdisciplinary elective course on Blockchain Technology at UG level and PG level is being designed and Courseware lectures were recorded at HAW Hamburg Germany under EU project – July 2018 (Where Dr Dhiren is one of the four resource persons).

The team also mentioned that the skills of the resource persons at VJTI, are enhanced by attending two training programs on Plasma Framework (Sept 2018) and Dagger (March 2019) from Matic Network Mumbai.

The team has brought to the notice of PRSG about the training/ programs conducted till April 2019. Though two workshops were projected, three workshops were organized; workshop on Blockchain Security at VJTI Mumbai was organized on Sept 2018, workshop on Blockchain Scalability and Sustainability at VJTI Mumbai was organized on Nov 2018 and International Workshop on Blockchain for Global Good organized by VJTI Mumbai was organized on 05 Mar 2019.

As per the objectives, two awareness seminars were conducted. Blockchain Challenges and Opportunities at NIT Surat during Oct 2018 for which 60 participants (students, faculty, and research staff of CSE, NIT Surat) have attended and one seminar was conducted on Blockchain Technology at VJTI Mumbai on Jan 2018 where 100 students have participated.

The team has mentioned that three hands on training programs were conducted as projected in the project objectives. Scalability of Blockchain Plasma Framework and Smart Contracts was conducted at VJTI Mumbai during Sept 2018 with 20 participants (students, faculty, industry). Hands on Blockchain Technology training was organized at VJTI Mumbai on 28 Feb 2019 for 32 participants (students) and another training was organized on 17Apr-2019 for 30 participants (students). The team also mentioned that 2 out of 2 finishing programs were conducted at VJTI Mumbai on 28 Feb 2019 (32 students) and on 17 Apr 2019 (30 students).

The team mentioned that one of the FDP program is scheduled during June 2019. VJTI team mentioned that Government officers training would be conducted during June 2019 as per the recommendation of PRSG.

The team further mentioned that they have eight publications in various international conferences.

3. **Future Plans**

   C-DAC

   Plan for next six months w.r.t Property Record Management Application include the following activities: a) Enabling production setup over the internet and integrating the Blockchain system with Telangana State existing application considering periodic syncing of records, resolving issues related to non-real time syncing b) Enhancing the existing multi-node setup with Kafka consensus, carrying out security and load testing and fixing the bugs c) Exposing the services provided by PM App through public IP and exposing APIs for sending the BCT logs to the Telangana Govt in timely manner (d) Design of CKYC based on the logic finalized by IDRBT and (e) Publications

   Activities for Security Assurance in Cloud include: (a) Add few more policy rules to the existing policy, (b) Implement module for inferring data from the collected logs (c) Implement GUI to display violation of policy rules (d) Deploy the solution on Openstack cloud platform and PoC (e) Publication

   Activities for Platform Enhancements include integration of PoE and PoS features.

   The C-DAC team planned to conduct one Skill based Training and one 2 workshops during May – June 2019 and another workshop during Nov – Dec 2019.

   IDRBT

   The Future plan for the next 6 months include (a) to continue the implementation of the Blockchain platform, (b) design and implementation of CKYC and (c) research on the digital asset management through Blockchain.

VJTI

Plan for next six months include (a) Inducting elective course on Blockchain Technology at CS/IT/EC (at Final year B.Tech, M.Tech and MCA), and Core course on Blcokchain Technology to be inducted in new curriculum of BTech CS/IT (at third year level) (b) FDP/Govt official training which is planned in June 2019 (c) exploring use cases to augment VJTI Blockchain (e.g. Certificate verification) and (d) Chain analysis to profile usages (Bitcoin and Ethereum)

4. **Funds Utilization**

   - The total approved cost of the project is ₹ 643.07 Lakhs and the first year fund is ₹ 348.10 Lakh (C-DAC: ₹249.80, IDRBT: ₹39.3 Lakh and VJTI: ₹59 Lakh). ₹ 339.10 Lakhs is received in the form of grant-in-aid from MeitY (C-DAC Hyderabad received ₹ 249.80 Lakhs, IDRBT Hyderabad received ₹ 39.3 Lakhs and VJTI Mumbai received ₹ 50 Lakhs)

   - The team informed that for C-DAC, expenditure was ₹. 2, 40,41,446/- as on 30th April 2019. Interest earned on C-DAC fund release is ₹ 1,01,581/- as on 30th April 2019 and is submitted to MeitY. C-DAC team requested for the release of second year fund once the Utilization certificate is submitted.

   - The team informed that for IDRBT, expenditure was ₹. 33,02,852/- as on 31st March 2019. Interest earned on IDRBT fund release is ₹ 22,000/- as on 31st March 2019 and is submitted to MeitY. IDRBT team requested for the release of the second year GIA, once the Utilization certificate is submitted.

   - The team informed that for VJTI expenditure was ₹. 41,43,394/- as on 30th April 2019. VJTI requested committee for the release of remaining fund (₹ 9 Lakh) of first year and release of second year of fund.

     The PRSG took note of it.

5. **Capital items**

   The team presented the status of capital items procurement. They informed the PRSG that they have procured the capital items as per the approved project proposal. C-DAC Hyd has procured Hash Engine Geforce GTS 1050Ti – 5 Nos, DELL EMC PowerEdge R440 – 2 Nos. Procurement of a server is in progress. IDRBT has no capital fund and so there is no procurement of capital items. VJTI has procured Compute Server Node in Rack (Xeon – 40 cores, 512 GB, GPU – Nvidia V100 32GB, 48 TB storage) – 1 Nos, One On-line UPS, One 24-port Switch and two Desktop PCs (one iMac and one Intel). The PRSG took note of this.

6. **Manpower**

   The team explained that the manpower working in the project are as per the approved project proposal or as suggested by the PRSG The PRSG took note of this.

7. **Recommendations**

The PRSG interacted closely with the project team both on technical and financial aspects related to the project and made the following recommendations:

- The PRSG has suggested the C-DAC team to carry out the availability, performance and scalability testing in the production setup of property record management system.

- PRSG suggested the team to come out with a precise process while calculating the hash for the documents as part of Proof-of-Existence (PoE) solution.

- The PRSG suggested the C-DAC team looking in to the SIEM (Security Information and Event Management) tools which are meant to collect log information from the devices and process the output.

- The PRSG has recommended the IDRBT team to explore on the techniques used by banks to ensure every customer gets a unique id may be studied and incorporated in the CKYC solution being designed.

- The PRSG has suggested the IDRBT team to design of the CKYC solution to be made in such a way that the logic can easily be integrated by C-DAC for their property management system.

- The PRSG has advised the IDRBT team to Classify digital assets considering the ability to handle cyber-physical systems that are complex combinations of both physical and virtual assets.

- The PRSG suggested the IDRBT team to explore existing solutions for digital asset management for a better understanding of the developments in the space that can then be leveraged and improved upon.

- The PRSG suggested the teams to submit a detailed report on capacity building initiatives and also circulate courseware developed in the project among the PRSG members, for expert suggestions.

- Considering the utilization of the funds, the PRSG recommended the release of remaining part of 1st instalment, and 2nd instalment of Grant-in-aid to VJTI, Mumbai based on the submission of Utilization Certificate by VJTI, Mumbai.

- Considering the utilization of the funds, the PRSG recommended the release of 2nd instalment of Grant-in-aid to C-DAC Hyderabad based on the submission of Utilization Certificate by C-DAC Hyderabad.

- Considering the utilization of the funds, the PRSG recommended the release of 2nd instalment of Grant-in-aid to IDRBT Hyderabad based on the submission of Utilization Certificate by IDRBT Hyderabad

- The PRSG recommended the request from IDRBT team to invite experts from academia and industry to contribute to the project, in particular to platform refinements and carry out research on Digital asset management using Blockchain.

The meeting ended with vote of thanks to the chair.

Annexure I

The following attended the meeting (2) of the PRSG

PRSG

- Prof. Veni Madhavan, IISc Bengaluru, Chairman

- Shri Deepak N, Customerxps, Bangalore, Member

- Shri Nagesh Shastri, NIC, New Delhi, Member

- Dr Sriram, DSCI, Hyderabad, Member

- Shri Tarun Pandey, MeitY, Member Convenor

Invitee

Smt Rama Devi, ITE&C Dept, Telangana Government

C-DAC, Hyderabad Team

1. Mr E Magesh

2. Mrs P R Lakshmi Eswari

3. Mr Mahesh Patil

4. Mr. N Satyanarayana

5. Mrs Jyostna G

6. Mr. Sai Gopal T

7. Mrs. Sireesha C

8. Mr Sandeep Romana

9. Mr. Ravi Kishore

10. Mr. Vikas Raut

11. Mr. Chitresh G

12. Ms. Aswini D

13. Mr. Sandip

IDRBT Hyderabad Team

1. Dr. N. V. Narendra Kumar

2. Dr Abhishek Thakur

3. Mr. K. Ravikanth

VJTI Mumbai Team
1. Prof. Dhiren Patel