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TATA Power Mumbai– Automation of interruption communication to Consumers & computation of reliability indices

Manish Thool (BE Electrical /M Tech (Energy Studies)
Power System Control Center
TATA Power Mumbai, Transmission

Abstract -
For electrical utilities, expectation from consumer about services has systematically increased in the sense of maintaining reliability & safety.Currently whenever a consumer or set of consumers experiences power disruption, they make a call to call -centres to address queries.SMS to consumer is being sent by Call Centers after generating no-supply status ticket. After getting feedback from Field Duty Engineer or LT Team for the concerned Zone, call center team issue communication to consumer & close the call /ticket. This paper describes the methodology adopted for direct communication to existing affected consumers while executing network operation as well as restoration of network. Methodology consist of integration of available systems viz GIS,SAP CRM & DMS which has reduced the cost to 1/10th of new market ready solutions of values as well as improvement in automation of computation of reliability indices.

1. INTRODUCTION

TATA Power distributes bulk as well as retail power supply across various segments within licensed area (LA). Power is being carried through a 220kV,110kV transmission network of high voltage lines from different generators as well as Grid. There are 17 RSS , 34 DSS in Mumbai for serving power to direct consumers at 33kV,22kV,11kV & 6.6kV voltage levels. The distribution node at PSCC is responsible for handling the TPC-D load of direct consumers at 33, 22 and 11 KV levels. TPC-D share (direct+ changeover+ open access) ~ 770 MW, out of which approximately 250 MW are our direct consumers load. While maintaining supply of quality power, it is essential to maintain reliability & safety in operation.

PSCC daily operation at distribution desk comprise of below activities : The responsibilities of distribution node include-

1. To provide uninterrupted power supply.
2. Real time operations.
3. Monitoring and control of distribution network.
4. Handling the tripping's /interruptions in network
5. Pre-planning, scheduling, arranging and cancelling the outages based on situation
6. Issuing the safety tags.
7. Co-ordinating with other parties involved.

1.2 Current Process of daily distribution operation during interruption :

Currently whenever a consumer or set of consumers experiences power disruption, they make a call to call -centres to address queries. SMS to consumer is being sent by Call Centers after generating no-supply status ticket. Call centres are getting location details of consumer who calls for no supply status. During feeder tripping event, call centre personnel usually sense the major outage based on calls received & they issued a link to FDE & LT teams of zone. After getting feedback from FDE or LT Team, call centre team issue communication to consumer & close the call. PSCC team who are monitoring the interruption restoration at DMS, doesn't have any active role in communication of status of affected consumers rather than sending message to consumers whose supply already restored by automated CSS operation by SCADA.

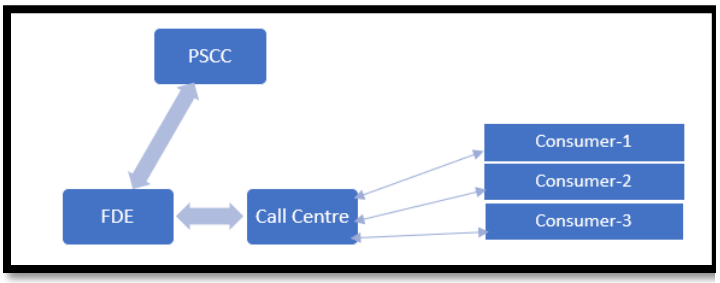


Fig.1 Shows present process of communication system

The barriers in above process are :

The affected consumer doesn't get the information of interruption as well as expected time of restoration for interruption.

The various difficulties are listed down below.

1.Time consuming

2. No communication to consumer about Expected Time for Restoration in the event of major fault

3. Delay in communication to call centre by FDE : PSCC Desk engineer as well as FDE focus on restoration activities primarily.

1.3 Application of existing software OSI PI across various wings of TATA Power :

TATA Power has existing software application for transmission requirements. The PI System is one of the application which is a suite of software products that are used for data collection, historicizing, finding, analyzing, delivering, and visualizing. It is an enterprise infrastructure for management of real-time data and events. The PI Server is the core product of the PI System.

The PI Data Archive collects, stores, and organizes data from data sources, providing an information infrastructure. The PI Server also includes tools for analytics, alerts, and auditing. The PI Server may be connected to almost any existing automation, lab, or information system. Operators, engineers, managers, and other plant personnel can use client applications to connect to the PI Server to view data stored in the PI Server or in external data archive systems.

PI Asset Framework (AF) allows the definition of consistent representations of organizational assets and/or equipment and uses these representations in analyses that yield critical and actionable information.

1.4 GIS Application at TATA Power :

Geographic Information System (GIS) is a platform to capture, store, analyze, manage, and present geographical data. GIS helps in improving efficiency and better decision making. TATA Power GIS comprises of geographically mapped network from Receiving Station up to consumer's meter for Mumbai Licensed area. It can be used for providing improved services in following areas.

GIS can help in monitoring the entire workflow related to the initiation of new scheme, approval, release, implementation and mapping through Design Manager. The information regarding the nearest CSS / Cable network / Feeder pillar shall be available for giving power supply to new consumers.

1.5 DMS application at TATA Power :

TATA Power has Distribution Management system (DMS) on micro-SCADA platform, presently 345 CSS & 16 DSS are connected to micro-SCADA system. Each of CSS is provided with FRTU & CSS modem which is used for connectivity to Distribution automation system.

The automated CSS in DMS system where status of Breaker controlling power supply to consumers (i.e. Transformer Breaker and or HT CTPT unit breaker) is taken on DMS for close monitoring of status. The network ring isolator perform the network operation for ensuring reliability.

1.6 SAP-CRM application at TATA Power :

TATA Power has SAP-CRM system catering to consumer database, revenue cycle management.

The request raised by consumer is being addressed by interaction center agent. He interacts with consumer, provides solution ,raise service request & communicate a message with service request by communication gateway.

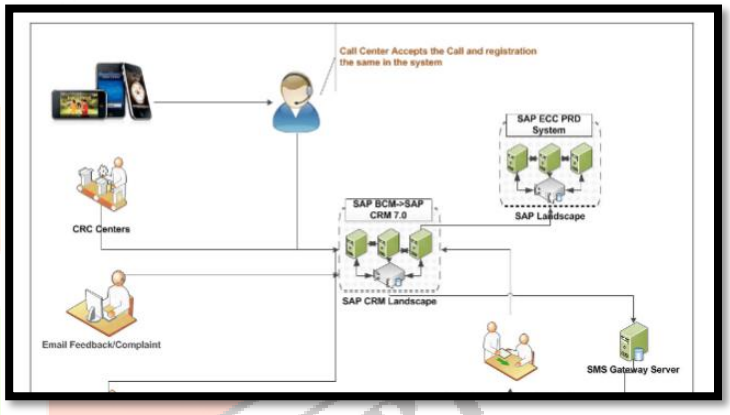


Fig-2. Process flow diagram of communication of consumer & Call center

2.0 Implementation of concept of integration of existing GIS,SAP-CRM & DMS :

A. An incident of power supply failure is triggered due to Tripping of feeder breaker in DSS/RSS/CSS. This incident would lead to loss power supply to some CSS transformers & HT Consumers in network. Also DMS would indicate line de-energized status of the affected network. The de-energized CSS status will be captured in the web-based system by integrating with PI system server which fetches real time status of SCADA network by development of network OPC keys for integration with SCADA.

B. The web page table containing information about CSS Name, CSS No., Installation No. and the number of connected consumers shall be made available at a network location by PI after a predefined interval. The incident table to be maintained in the Web based system data base and is subsequently updated.

C. On an incident, PSCC team shall start restoring supply to affected CSS remotely for the automated part of the

network, the restoration time as stamped in SCADA is captured in the Web based system.

D. After possible restoration the PSCC team would check with the field engineers on the status of remaining de-energised CSS (Whether restored thro' LT/DG) for other restoration methods and the expected time of restoration (ETR) in case same cannot be restored. The ETR for non-restored CSS and Restoration time for stations which are restored through LT to be updated by the PSCC team on the Web UI along with a tick to enable initiation of SMS alert to related consumers.

E. Reliability indices report of utility TPCD based on event will be calculated automatically.
i] System Average Interruption Duration Index (SAIDI)
ii] System Average Interruption Frequency Index (SAIFI)
iii] Consumer Average Interruption Duration Index (CAIDI)

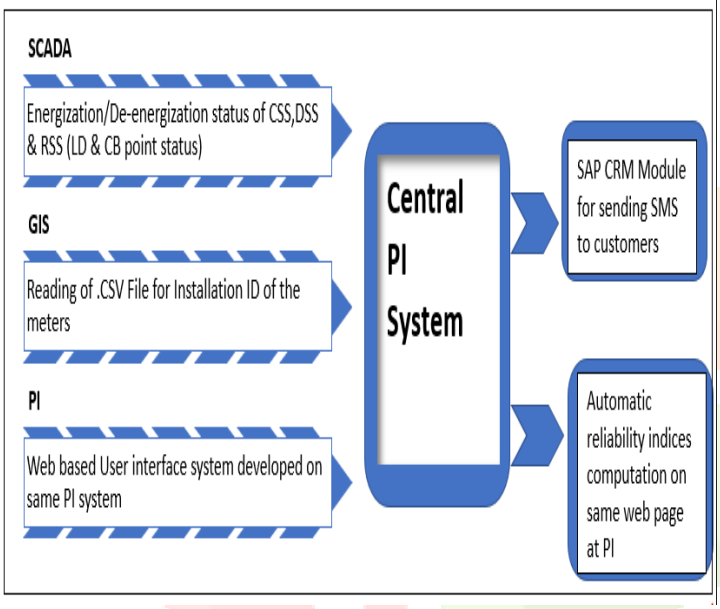


Fig 3 – Proposed flow by integration of SCADA,GIS,SAP-CRM

2.1 Uniqueness of implementation of the project :

I. First time inhouse integration of existing SCADA with SAP CRM & GIS database on the PI soft server. Further development of User Interface for monitoring of the incident happened on real time basis on the field

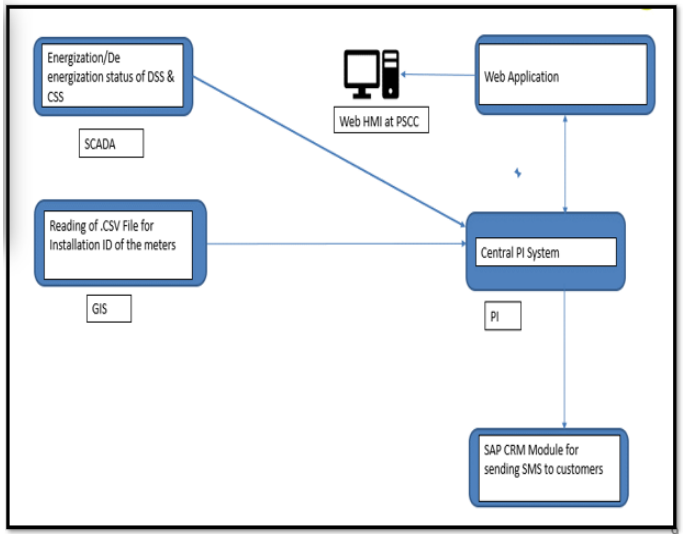
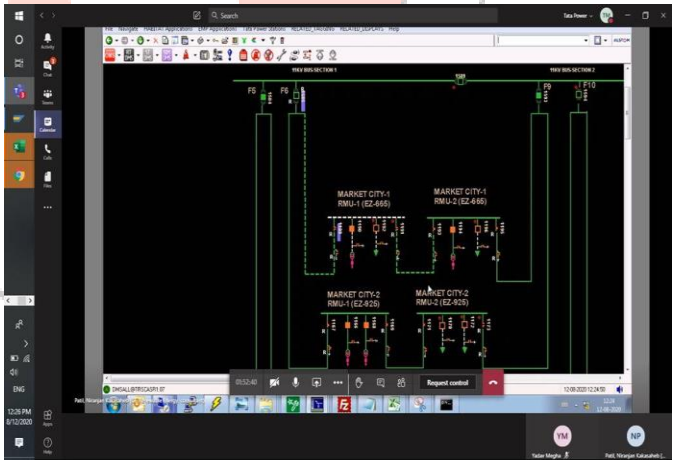


Fig 4 – Architecture flow of integration for sending SMS to consumers

II. The rigorous testing of network topology across all TPCD voltage network for ensuring correct propagation of data from SCADA to OPC & OPC to PI keys. Further testing on SAP CRM database for SMS communication based on development of dummy consumer contact database. This was critical phase in terms of identifying the error in network database, OPC & PI correction, review of database of SAP CRM & GIS consumers etc. Finally computation of reliability indices based on closure of incident by PSCC engineer which in final closure.



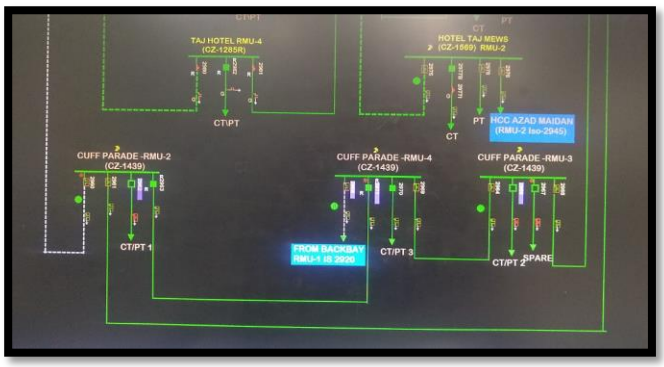


Fig 5 – SCADA screen images of Network Topology with testing

III. The web page table containing information about CSS Name, CSS No., Installation No. and the number of

connected consumers shall be made available at a network location by PI interface after a predefined interval. The incident table to be maintained in the Web based system data base and is subsequently updated.

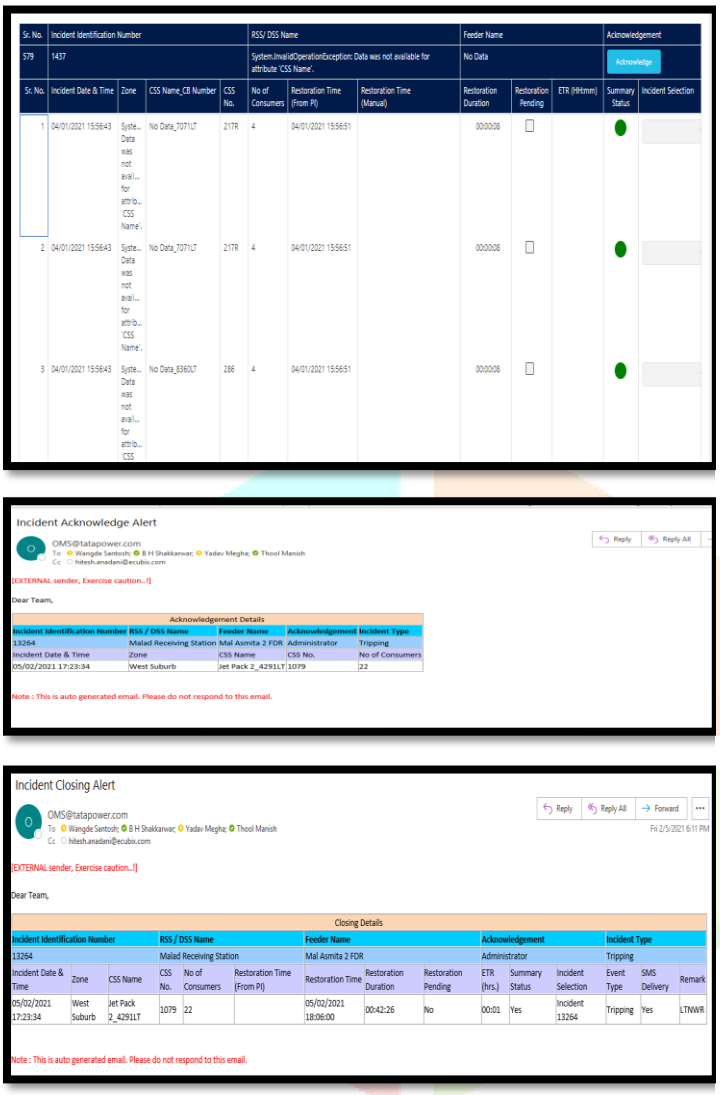


Fig 6 – Above screen image of web interface & auto triggered mail communication to concerned parties

IV. Key achievement :

- SMS being driven by restoration activity operation, no third party intervention. Data Quality improvisation based on restoration done in SCADA network with validation. Precise delivery of SMS with quality information to affected consumers for situational awareness system based delivery of incident report.

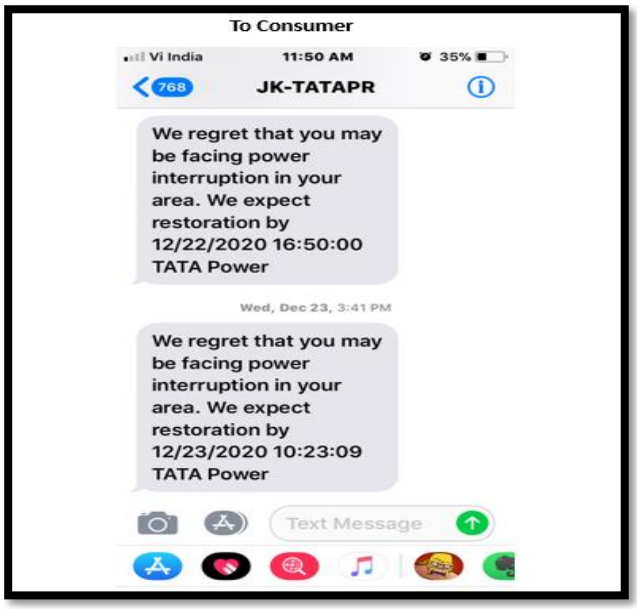


Fig 7 – Image of SMS sent to affected consumer of TATA Power

- Immediate communication of expected time of restoration in case of tripping of network. This will immediately alert consumer for proactive action at his end during ETR.
- Based on automated restoration operation & communication to consumers about ETR directly, the interaction of TPC-D FDE with call center team would be reduced. Also consumer direct communication with FDE for enquiry of ETR would be eliminated after sending auto SMS proactively by system itself. Less human intervention for computation of reliability indices i.e. leveraging the platform of digitalization of activities & services.
- Reliability indices report of utility TPCD based on event will be calculated automatically. i] SAIDI ii] SAIFI & iii] CAIDI.

6. Conclusions

In tata power through experiences ,development of project has below advantages :

I. First time inhouse integration of existing SCADA with SAP CRM & GIS database on the PI soft server. Further development of User Interface for monitoring of the incident happened on real time basis on the field

II. The rigorous testing of network topology across all TPCD voltage network for ensuring correct propagation of data from SCADA to OPC & OPC to PI keys.

III. Further testing on SAP CRM database for SMS communication based on development of dummy consumer contact database. This was critical phase in terms of identifying the error in network database, OPC & PI correction, review of database of SAP CRM & GIS consumers etc

7. ACKNOWLEDGEMENTS

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8. **TEAM MEMBERS**

a. Pallikuth Devanand (Head PSCC -TPC PSCC)
b. Deepak Mhase (Chief Manager -TPC- PSCC)
c. Milind Laxman Gole (Chief Manager – TPC PSCC)