Critical Role

Challenges and synergies in the use of IT in power

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Information technology (IT) has, from the early stages of power systems development, contributed to the sector and influenced its growth. Initially, the concept of power line carrier communication (PLCC) involved voice communication over hundreds of kilometres. Even today, PLCC is probably still the media offering the longest single-hop terrestrial communication without the need for repeaters or signal boosters. PLCC was a success in the power sector for both voice communications and low speed data transfer for telemetering. It also served as the carrier of signals for teleprotection systems using teleprotection couplers in the audio frequency.

The advent of optic fibre communication systems saw a gradual decline in the use of PLCC. One of the first optic fibre links in the Indian power sector was commissioned in 1984 between the Tata-Trombay generating station and the Carnac receiving station for a 110 kV line. This project was a part of the construction of India's first 500 MW thermal power plant.

Fibre optic systems led to the next stage in the use of IT in the power sector. High speed fibre optic networks allowed the deployment of supervisory control and data acquisition (SCADA) systems, through which process data could be transmitted to the remote end on a real-time basis. If necessary, SCADA also allows remote control of equipment at the other end. Then came the energy management system (EMS) and its variants using SCADA, through which operators of electric utility grids could monitor, control and optimise the performance of generation/transmission systems.

Today, IT and its tools have been successfully deployed for power generation plants, transmission line control, receiving stations, substations, distribution system automation, consumer metering (including remote metering) and billing, energy accounting and audit, load management, system healthiness monitoring and management, and revenue/commercial management. IT tools are helping utilities in system prediction, annunciation and enabling them to reduce their efforts in an intelligent manner.

Business challenges

Though the power sector has been relatively less affected by the recession, some impact can be seen on investments and project funding. Overall, the past few years have seen the challenges and complexities increase manifold.

The Electricity Act, 2003 promotes competition and liberalisation in the sector. To keep the business environment balanced, utilities need to re-engineer their strategies and automate business processes for sustainable growth and continued survival. The use of the latest, cost-effective and need-based technologies is essential to meet the objectives. IT is therefore seen as a major thrust area in transforming the power sector.

IT challenges

There has been a steady development of IT systems specific to the power sector. A number of IT solutions are available, and it is necessary to select the most suitable, cost-effective technology for specific applications. The selection of technology is based on both short-term and long-term business requirements. Some of the factors usually considered are as follows:

System response time

System response time is the most critical factor and is defined as the response provided by any system to its connected users or customers. The acceptable levels are usually less than 1-1.5 seconds in a local environment or 2-4 seconds when connected to a remote system. For example, an operator on the human-machine interface of a SCADA system expects instant response. A delayed response will put the operator in a state of uncertainty. Hence, the design has to factor in the response time for user acceptance. Connectivity bandwidth to link systems is of great importance. Depending upon the architecture design, additional tools for improving the system response time may be necessary.

Ability to develop customised solutions in a time-bound and cost-effective manner

India is power deficit and will continue to remain so for the next few years. In such a scenario, it is necessary to despatch maximum power and balance the market in an optimised manner. It is therefore important to develop solutions to meet utility needs in acceptable time frames, keeping costs under control. The use of ready-made solutions might help in the beginning, but is not advisable in the long run, except if the solution is customised to meet Indian market needs. For example, Power Exchange India Limited (PXIL) developed the Power Exchange Application using a customised solution in a time-bound, cost-effective manner, rather than deploying a standard solution available in the market.

Architecture design with high availability

The power sector operates in a real-time environment. It is vital to ensure continued service availability with acceptable performance levels. The choice of hardware involves servers and devices with fully redundant, fault-tolerant designs. However, for a better performance-to-price ratio, conventional servers designed to operate under high availability can be

used to manage costs without affecting performance. For example, the use of dual power supply and CPU for a hardware chassis, redundant data links, diverse service providers for data links and redundant input AC power supply lead to better system design and availability. A Tier-4 data centre is a classic example of high availability and robust architecture.

The most common hardware platforms include Intel (on the Windows operating system) or Unix variants (HP Unix, Sun Solaris, etc. are the platforms currently used). Platform selection is based on the type of application, capability to build security layers, investment and interoperability with other systems. Unix is a three decades-old operating system. Though debate continues as to which operating system is better, Windows has matured over the past six years (after Window 2003 and XP) and is now the de facto platform due to the availability of trained manpower with the desired skill sets, development kits, fast development time, economical costs, improved security levels, etc. However, the selection of the platform depends completely on the user. Both Unix and Windows continue to be used in critical environments.

Ease of deployment is an important part of systems development, including the way updates are handled for users. System maintenance management can also be improved through a process of continuous feedback from the users and all stakeholders.

Interoperability and scalability

While the systems are designed to do their primary tasks, they have to interoperate with the adjacent systems and networks. A good system design would factor in the current usage and future growth, both in terms of users, transactions and location spread. While every organisation aspires for the next level of growth, the scalability factor and business expansion should be debated for IT design optimisation. At the same time, growth in technology would help obtain better systems at an economical cost. Investments in IT should therefore take into account the current requirements, incorporate provisions for expansion without changing the basic engine, and then look for phasing out the system. For example, SCADA remote terminal units (RTUs) follow a proprietary protocol to connect to the SCADA system. However, one RTU of a system, say, an RTU of ABB SCADA, is not interoperable with another SCADA system, say, an RTU of GE Harris SCADA. It is therefore necessary to use standard protocols at the design stage to ensure interoperability between systems.

Obsolescence is fastest in IT and hence a perspective plan for system design can be evolved after business acclimatisation.

Multiple levels of authentication and security with role-based system access

Authentication is a process to verify the user's credentials, allow authorised access and drop requests from unauthorised users who can be potential miscreants. A user ID with a password is the common form of authentication. Going beyond the usual processes would improve security levels. As such, the use of additional authentication based on global IP address locking, local IP address, MAC address, etc. offers enhanced levels of security.

Disaster recovery and business continuity

Disaster recovery (DR) is the process by which an organisation can quickly restart its operations by ensuring sufficient IT infrastructure to maintain business sustainability. Business continuity planning (BCP) is a systematic approach to ensure the availability of not only IT systems but also the people who run the organisation and its infrastructure, in case disaster strikes.

For DR, organisations usually replicate systems at separate locations, usually at more than one place; ensure the availability of systems back-up on a regular basis to protect vital data; and ensure its recovery in case of unforeseen events. Back-ups are maintained for applications, database and the operating system for faster restoration. For real-time mission-critical applications, dedicated servers are maintained with clustering and RAID support. Online or scheduled replication for DR systems paves the way for high availability and faster recovery.

While DR largely involves IT systems and processes, BCP has a much larger scope of determining the minimum critical resources needed to run an organisation, and stationing these resources at a different physical location to operate their own, separate IT systems for running the business if a disaster occurs at the primary location.

The decision to opt for BCP is usually taken after the organisation achieves stability through the streamlining of operations and business processes, but a DR system should be put in place as soon as possible. All leading financial institutions have DR and BCP in place to ensure that their business continues as usual.

Synergies between IT and business

While IT is ready to deliver the solutions, the requirements and forecasts have to emerge from the business teams. IT systems can be designed accordingly. But once the requirements are firmed up, changes to the basic system should be avoided. Not only does this create confusion, it also leads to a longer development period as the development codes have to be altered. Regular coordination and mutual updates help to create synergies between the IT and business teams.

IT investments are large and an effective business plan assists in managing the cost and reducing expenditure. With well-defined budgets, it would be possible to make regular forecasts for IT investments while deriving more benefits.

The power industry works on lots of data from multiple locations. While it is a challenge to obtain all such data, organisations need to move towards defining and automating the internal processes to reduce the cycle time, strengthen the authentication of users and automate all processes. Information is the key to success and the transparency of information is the key for business sustenance. ■