SPE 99336

EPINET in ONGC India: Transforming E&P Information Into Energy Intelligence

P.K. Mittal, ONGC, and D. Chatterjee, Schlumberger

This paper was prepared for presentation at the 2006 SPE Intelligent Energy Conference and Exhibition held in Amsterdam, The Netherlands, 11–13 April 2006.

Abstract

Indian state-owned Oil and Natural Gas Corporation (ONGC) is nearing completion of a major data management initiative that began in 1999. This paper presents a case study of the Exploration & Production Information Network (EPINET) Project. Rather than communicating detailed facts and IT aspects, the paper will show how EPINET has dealt with the critical "people, process, and technology" aspects of project implementation. It also includes a discussion of maturity levels in data management and how EPINET is helping the company to evolve along the maturity path in its information management practice.

The objective of the EPINET project was setting up a live E&P information network across the length and breadth of India. It included setting up infrastructure (machines and software) in as many as 18 sites, empowering the sites with suitably trained people, and creating and implementing policies and procedures for managing a steady flow of information. It required standardization, change management and motivating people. It ongoingly deals with data aggregation, organizing disparate information, and providing easy and free access to information.

The project targets information sources (field offices known as assets, basins, forward bases, laboratories and interpretation centers) and utilizes the "own, populate, use" model to manage data quality. In short, the EPINET project brings a paradigm shift from personalized local databases in individual personal computers to a truly integrated countrywide corporate database. The ultimate goal is to improve the quality and speed of business decisions through more efficient team collaboration. This is enabled by the availability of reliable multidisciplinary (seismic, wireline, well completion, drilling, and production) technical data. The EPINET project is expected to create substantial value for the organization.

ONGC

"*We are ONGC. India's most valuable Corporate, public and private combined. We have discovered five out of six Indian basins where ONGC and everyone else produce oil and gas. Our investment abroad adds up to over 3 billion USD. The LPG cooking gas in 1 out of 6 cylinders comes from our plants, and CNG also comes from our gas. We own and operate the largest oil and gas pipelines in India. Our refineries at Mangalore and Tatipaka are running at 100% plus capacity. Our scientists and engineers operate at the cutting edge of technology. We use one of the most powerful computing and networking systems in the country. Every year, we invest 2 billion USD to create and renew assets. Our facilities and installations are insured for nearly 12 billion USD. ONGC, committed to the goal of making tomorrow brighter*." – This manifesto from ONGC's public relation campaign gives a description of the company, which has undertaken the ambitious EPINET project.

EPINET

EPINET stands for **E**xploration & **P**roduction **I**nformation **Net**work. Fig-1 shows EPINET plans for implementation of infrastructure, software and people in 18 centers across the country.

A number of key decisions were made that became fundamental conventions for project implementation. Assets, Basins and Forward Bases who generate the data, would own such data. Owners would also manage their data. EPINET project teams would be the custodians of data. An asset-focused distributed data management organization, controlled centrally, was adopted for successful data management.

Why EPINET?

This project was initiated because a team of people had a vision, and could see the value that quick and simple access to valuable data and information assets could greatly improve the productivity and efficiency of the company. The team also understood that substantive exploration and production successes and significant cost savings would come from better more confident decisions made with complete and accurate information.

During a review meeting a senior officer from ONGC said that ‘when I joined the company as a young Geologist, my boss used to complain that I am constantly spending time in looking for data’. Hence, in his opinion, it would be a ‘dream come true’ if all crucial Petrotechnical data were available at his fingertips.

Unorganized data

Imagine e-mails kept without any structure or organization. Specifically, the case of someone who has in his mailbox several thousands of archived email messages. Fortunately, it is still possible to search and look for a mail coming from Mr. XYZ on topic ‘so and so’ during a certain period. But when data and information are scattered across various locations, departments and people, and much of it is on paper, there is no magic search command that can easily retrieve and collate such dispersed data.

Managing this distributed unorganized data required a suitable database technology and rigour in the way data would be maintained across various sites all over the country.

Technology

After suitable selection process, the Infostream family of products from Schlumberger Information Solutions was opted for utilization. Given below are descriptions of some of the products. Fig-2 shows collection of results from EPINET.

General database tool - uses Oracle RDBMS engine for managing master data offering a wide variety of tools to validate, store, visualize, analyze, find and access corporate data. The industry-standard data model seamlessly integrates virtually all types of exploration and production information required for data analysis, interpretation and knowledge management.

Well log archival tool - stores data in original format to preserve 100 percent of the original log data acquired by the various service companies. Archived data sets are kept in original formats but are delivered in desired corporate formats. Metadata dictionary contains log data encyclopedia, which is easily consulted when needed.

Seismic data archival tool - archives and manages huge amounts of seismic trace data. During the transcription process information from the original tapes, navigation and trace data are combined and catalogued to create a searchable Oracle database. Archived data are selected by querying the database. Data is retrieved from the mass storage system and automatically delivered to the processing, workstation or output environment.

Drilling data management tool - provides users with intuitive tools to collate, monitor, query, plot and analyze the company’s drilling information. Drilling information is always easily accessible to support drilling, planning and real-time decision-making processes.

Web-based access tool – this tool delivers secure information throughout the company via the Web. Multiple data sources are presented in a variety of formats through customized, secure, domain-focused pages, supported by an integration framework. Users have immediate access to the information they need for seamless workflows and faster and more accurate decision-making.

Customization required

During EPINET implementation, it became apparent that local customization was necessary to completely satisfy user requirements. Hence, the solution was customized in a collaborative manner, with input and requirements coming from domain experts. Customizations were done in areas of: data model, business objects, data entry form, Oracle report, other web-based reports, special programs to aid EBCDIC header editing of SegY files, and many others.

Aggregation

For the EPINET project there were two fundamental requirements. The first was the need for data capture at the source. The other was providing a summary view for users at regional and corporate offices. This aggregation capability established a real network (The NET in EPINET) across the organization. Thus a culture of “Own, Populate and Use” was put into practice among the true owners of data.

The aggregation created a superset of all the asset-level Finder projects that is synchronized with ongoing changes taking place at the data generation source (assets). It also provides data redundancy for safety backup. By having a superset at both the basin level and the corporate level, users can have a local view of data of interest at the regional or national level without having to depend upon network performance. Synchronization is typically scheduled overnight and thus does not clash with regular EPINET operations during working hours.

Fig-3 shows that the data from Ankleshwar, Cambay, Jodhpur, Ahmedabad and Mehsana is aggregated and archived at Baroda basin. Similarly, data from other asset offices also get rolled up to respective Basin servers.

In the next level, data from each basin such as Baroda, Mumbai, Chennai, Jorhat and Kolkata is aggregated and archived at the corporate center, Dehradun.

All changes made to the database at the assets (either newly data loaded or edited existing data) are reflected at the basin and corporate database. Therefore, a synchronized database is achieved at Dehradun, which reflects the changes that occur at each asset and basin.

Process

Information management has two major functions: data administration and data access. Data administration consists of loading, validating, editing, and integrating data, and is usually performed by data management specialists. Data access consists of finding, browsing, viewing, and sharing data, and is commonly performed by E&P professionals, often using web enabled data browsers.

A simple analogy helps to explain this. “Data administration” can be equated to the function of news editing team of a popular newspaper. Where “data access” can be equated to the numerous readers of that popular newspaper.

When we speak of “process”, this applies to the rigour and discipline that is associated to the task of data administration. By adhering to a set of well-defined processes, ONGC’s EPINET team can more confidently ensure quality data archive.

Task-force approach

In addition to the management team of EPINET data managers, discipline specific teams termed “Task Forces” were also formed for each of the disciplines: geology, seismic, production engineering, reservoir engineering, drilling, logging, laboratory and software. Each discipline team had one expert from appropriate Basins, Assets or Institutes. The immediate objective of the task force teams was to iterate on the technical requirements for data capture, standardization, customization needs, and data report generation in their respective areas and recommended workflows.

Below are some samples, not an exhaustive list. The examples are not universal to be used worldwide by any E&P company. In any case, they are cited here to illustrate the effort that was spent during the lifetime of EPINET project to get the right brains together and formulate some principles.

Geology task-force –

The selected group of geologists identified that three major tasks need to be addressed on top priority for having data uniformity across the company which are:

(A) Standardization of codes and nomenclatures of various data attributes including Unique Well Identifier (UWI).
(B) Customization of data model / applications.
(C) Stratigraphic scope moderation and implementation for old and new versions pertaining to Indian Sedimentary Basins.

Two additional tasks were:

(D) Formulation of workflow and data loading procedures
(E) Rationalizing well status and well symbols for drawing well locations on map.

The Reserve Estimate Committee (REC) of ONGC has established standardized nomenclatures for Payzones. Within the EPINET project it was a requirement to ensure that all REC standards for pay zones and reservoirs were used by all concerned domains.

The complete listing of pay zone nomenclatures as per REC tables for all basins was compiled per Field and distributed along with task-force report. Sample Payzone in Assam Shelf is given below as an example.

1	TS I	MIOCENE
2	TS II	MIOCENE
3	BARAIL	OLIGOCENE
4	BARAIL SST	PALAEOCENE

Seismic task-force –

The seismic domain experts standardized survey names, line numbers and also EBCDIC header contents for 2D & 3D data.

All the processing centers were advised to strictly follow the recommended formats for the EBCDIC header without violating the columns and rows. Recommended formats for Binary and Trace header parameters were also adhered to. The representatives of the processing centers involved during the task force meetings also accepted this convention. For old data EPINET centers were advised to fill up gaps from available films, sections, reports, etc. The Task Force also defined recommended workflows. Mandatory parameters and optional parameters were decided to maintain uniformity in headers.

Production task-force

Over multiple sessions, the group of production experts looked at various data samples from multiple sites, deliberated and came up with a common set of recommended attributes for each data type. This set was respected while designing entry forms, reports and other database objects. Given below are two examples.

Perforation details
(Multiple rows corresponding to different layers such as A1, A2)
Layer name
Top depth (m)
Bottom depth(m)
SPF
Perforation Diameter (in)
Perforation length
Perforation medium
Shot angle
Shot phase
Current status (Open, Squeezed, Closed)

Production Test attributes
Well no
Date of test
Sand/payzone
Production Mode (SF, GL, SRP, INJ etc.)
Separator pressure kg/cm2
Bean size mm
Liquid production m3/d
Formation Gas production 1000m3/d
GOR v/v
GLR v/v
WC %
FTHP kg/cm2
CHP kg/cm2
ABP kg/cm2

Quality control

Quality control is a critical step before accepting any data into Corporate Master Database. Data Managers must validate data using standard QC tools. This is an ongoing process. When someone finds a city's temperature in yahoo, or a map from MapQuest they simply believe it. This is because people know a lot of effort has gone behind the data collection and validation. Similarly, Data Managers must work to build a level of trust with the users.

Provided below are examples of some of the common QC steps that are taken for EPINET data.

1. Make representative maps of locations of seismic lines and wells for QC check and to detect logical errors.
2. Ensure that core sample depths fall between the coring intervals.
3. Data owners validate data before loading for well completion reports.
4. Approved values for analysis type, measurement type, material type, activity type etc. are stored in “Codes Schema” and the system automatically checks for their correctness before allowing new entries.
5. The domain specialists specify the standard values to be stored in “Codes Schema”.
6. Run SQL queries to check for data violations such as:
   - Completion date before spud date?
   - Directional survey depth deeper than driller’s total depth?
   - Do short names (L120) actually relate to respective well names (ex: E-LLKM-119)? Or are there obvious mismatch that can be detected by script?
   - Other checks that make sense for the data.

Above are examples only. Throughout the implementation of the EPINET project, Data Managers constantly evaluating data quality: detecting data issues and consistency problems by visual or logical checks.

Additional quality control tools and processes included:

QC in Well log archival – the Data Manager carefully matches real log prints with screens to match log header information and carefully adds information directly into the screen to supplement. This validates and enhances data quality compared to simple cataloguing of DLIS/LIS/LAS files. When retrieving, users may request either the original log data (with gaps in header information, if any) or edited export (which will recreate a DLIS file after respecting corrections done while loading the data).

QC and pre-processing in Seismic data archival – While archiving post-stack SegY files into EPINET, data is first edited as per company convention (laid out by seismic task-force) so the EBCDIC header depicts both acquisition and interpretation steps in a consistent manner. A separate program (SegyEdit) is used by Data Managers to check consistency of data against multiple (EBCDIC, Binary, Trace) SegY file headers. To maintain consistency, additional software was developed to pick up data from the Master database for header editing . Data managers can then add missing values if necessary.

Integration aspect

Data integration is a strong theme for EPINET. After a great deal of effort to ensure quality, the Data Managers worked to create a ‘one-stop shop’ environment for all disciplines to allow domain specific technical experts to leverage synergies and overlap among data from various disciplines. If left in separate silos, users could introduce inconsistent nomenclature for the same data type. Zone 'L1, 'L2' may exist for geology people, whereas production people refer to the same zones as 'L-I', 'L-II'. Production people might use well name as N6LS, N6SS instead of saying well ‘N6’ and production from LS and SS strings. If such anarchy in naming convention is allowed, it becomes very difficult to allow collaboration among various disciplines.

Common codes

Codes are data lookup values. An example could be the list of additives used during cementation. EPINET enforces strict discipline to maintain uniformity of codes across the country. This is not just a one-time effort; rather it requires regular monitoring. Users in Chennai are not allowed to add local codes, without consulting Headquarters in Dehradun. Similarly, users in Baroda are not allowed to use a revised version of the data entry form. As people get transferred within India from one location to another, the learning curve is minimal since consistency is maintained.

Policies, procedures

During the implementation phase of EPINET project, the team carefully prepared a ‘Policies and procedures’ document for each major data type. These documents clearly dictated steps

required to accept data into the Corporate Master Database. EPINET project coordinators ensured that such policies were implemented strictly in all sites, without any deviation. In the O&G industry, company employees respect how safety measures are enforced from an HSE standpoint. In the EPINET implementation, the team intended that recommended processes should also be respected with equal seriousness.

Fig-4 shows EBCDIC header template as recommended by Seismic data task force. All SegY files, before loading into EPINET, are edited to adhere to this standard. In 'Seismic work-flow' document, this step is listed as mandatory before archiving SegY files into EPINET.

Security, entitlement

As, in the case of a bank, much care is taken in EPINET to provide the right level of data access to various groups of users. For example, only users with a geology role can enter core/cutting data. Additionally, only users with reservoir role can enter information about pressure gradient survey. Most authorized users can access the data in read-only mode. However, care is taken to prevent unauthorized users from retrieving data that is classified or private.

In addition to role-based access control, and additional layer of advanced level of entitlement was used in EPINET. This is defined as row-based access control where specific data (ex: list of wells with classified information) can be made accessible only to a small group of users or to a specific user (ex: Consultant for Field study), restricting his visibility only to a small subset of data, as per business needs.

People

Obviously, the success or failure of a large project like EPINET depends upon availability and dedication of the right number of people with the right skill sets.

However, ONGC has an ever-expanding set of activities and acute shortage of manpower was reported at most of the sites. To have a workable solution, a mix of full- and part-time managers have been associated with EPINET. While full time data managers and domain specialists at various sites were assigned responsibilities for their specific roles in the project, part-time technical experts were involved with specific responsibilities to provide data, carry out validation for data pertaining to their specific function and sometimes carry out assigned amounts of data loading.

Blend and mix

EPINET project coordinators used a mix of people in the core teams in each site. Half of the people had an IT background, and the other half had a geosciences background. This worked well as each half complement the other. IT professionals bring the expertise in handling of database, scripting etc., whereas the domain folks bring the sanity check. As the domain specialists understand the data, QC process becomes a natural thing and they can easily spot data anomalies. The two domains together could utilize EPINET data in the best possible manner.

Reward from Management

Various project team members felt that operational jobs were more rewarding than this supporting work to enrich the data archive. To ensure successful implementation, it was important for the senior managers to get the best quality people in EPINET team. This was achieved by obtaining suitable management buy-in through regular presentations, meetings and briefings. Once higher management was convinced of the value and utility of EPINET's outcome, they began to assign the best resource to the project. Management also provided motivation by providing opportunities for advanced training commensurate with the achievements.

Training

An extensive EPINET training program was conducted covering the various facets of E&P data management i.e. System Administration, Database Administration, Seismic trace management, Original Log management, Asset data management, Drilling data management, Production data management, Petrophysics/ Geology, Project Administration, E&P data population and E&P end users training, so geoscientists and engineers could extensively and fully utilize the deployed technology. During Phase-I of the project 155 Geoscientists/ engineers were trained. Schlumberger trained about 460 more geoscientists during Phase-II through centrally organized classroom trainings.

Working closely with ONGC, Schlumberger set up an in-house training center in India at New Delhi. Users were trained just prior to beginning work in the new environment. To customize the basic application training courses for ONGC, Schlumberger utilized senior trainers from their overseas office. The trainings were on-line and interactive, utilizing the software being deployed. General feedback received were very positive. Based on the feedback, requisite corrective measures were taken for the continuous improvement of the training deliverables. EPINET training delivered the desired know-how to geoscientists and engineers performing management, administration and usage of E&P data through EPINET.

Still, the most effective training takes place on-the-job by utilizing real data. On-the-job training and workshops were organized for the primary applications as well as for customized solutions. This enabled EPINET teams to carry out bulk as well as current data loading independently at all sites.

KDMIPE, Dehradun is the nodal centre for EPINET project implementation and provides support to all sites.

Information Management Principles

It is relevant to discuss certain aspects of Information Management principles in order to appreciate efforts undertaken in EPINET project.

The first step, transparency

The very first objective is to ensure that all relevant data are made freely available and ensure that data does not reside in various 'pockets' any more. Data are not private property; rather, they are a corporate resource. There is an obvious benefit of such transparency. As they are freely available, data gets validated in a natural manner.

This sounds trivial, but is rather difficult for a company like ONGC where there is vintage data going back to 1960s. There is also the problem of differences in convention; Ankleshwar keeps some data in one way, whereas Rajahmundry keeps the same data in another way. There is the challenge of devising a common format whereby the entire country's data can be presented in a uniform format. This also has to take into account the inherent differences from onshore and offshore operations.

Fix data custodian

At the next level, we create data custodians. EPINET team members are the custodians where as Asset/Basin Managers/Chiefs of services are the data owners. Owners provide and validate the data. Custodians ensure the integrity, consistency and updating of data. They also look for data gaps and contact sources from within the company to fill the gaps and ensure completeness of data. They also help to ensure acceptability of data by enlisting domain specialists to resolve conflicting views and promote use of standards.

In addition, the software system should provide the electronic signature ‘announcing’ that a specific data class is completely loaded after suitable QC, for a specific well. Any subsequent update will mark the data as 'tainted'. This challenge is more crucial for dynamic data such as production data. For such a data type, this kind of 'closing' is periodic. And for these data, it is common to use a different unit of grouping; for example, we have validated and loaded the monthly production volume for field-XYZ for the month of Nov-2004. The custodian provides a single 'electronic signature' as mark of approval. This cascades down to the individual wells and producing strings, intervals, completions that are in field XYZ.

Flag state of completion

It is also important to mark a state of completion of 'looking for data'. When the database shows the user that there is no core data for well-123, the user is not sure if the core data exists and still may be loaded by Data Managers at a later date, or if the Data Managers have checked and established that there is no core data for this well. A mark of completion is required that represents a different state such as ‘pending’ or 'work in progress'. In some cases, one may include background information about ‘work in progress’ saying that we are waiting on the petrophysicist to provide average saturation for a new well and that ELAN processing is in progress. Data Managers are then prepared to change the status as soon as the relevant data becomes available and gets loaded. The system should help the Data Managers in setting the flags in automatic manner.

Decide what to store for eternity

The fact that the field geologist had breakfast at 8:30 AM on 12-Dec-1991 while he was witnessing a logging job, is probably not that significant from geotechnical standpoint. But it is important to record that there was a logging operation done on that day by contractor XYZ and these services were run for this time interval. In addition, high level summary of logging operation as well as detailed (every 6 inches) well log data are important to store in the archive database.

Decide what to store in relational format

Having decided what data is important to store long-term, it is reasonable to decide what data items should be stored in relational format. If nobody will ever make a relational query to access this data, it does not warrant the effort. It is practical to maintain hard copy report in library and simply maintain a catalogue of such information. It is also possible to keep a scanned copy of the report. Most recent reports should be available in soft copy. It makes the most sense to store the soft copy and attach to relevant E&P element(s), such as well, core (ex: Special Core Analysis report, Geochemistry reports), and fluid sample (ex. PVT report).

Always think of the possible query methods used to access and use stored data. Will someone simply like to read an old report, or will there be a search for specific attributes across multiple wells?

Often, the Data Manager may decide to apply both techniques for storing data for long-term. As an example, consider detailed textual report of Initial Production Testing of a well, where various objects are tested for hydrocarbon potential. The story-like remarks (hour by hour) are useful to keep in text format, but certain data attributes need to be parsed out

and kept in relational format so that users can make ad-hoc queries looking for information trends. Examples of such useful attributes from an Initial Production Test data are: Object number/name, date tested, perforation details, flow-rate of oil/gas/water and some high level remarks.

Data utilization

Web access

Going with current trend of web access of information on the Internet, EPINET made a strong effort to provide pervasive and easy access to loaded data. The browser interface is similar to Windows Explorer from Microsoft that is familiar to technical users. Fig-5 shows a typical screen from the Web Access tool. This provides a tree-like structure of oilfield, its wells, and different data types for each well.

Fig-6 shows a specialized web access screen for drilling data. This screen is specially suited for this data type with embedded analysis capability. For analysis, it is possible to drill down on a single well's activity. It is also possible to look at a portfolio of wells and do multi-well data retrieval. Another advantage of having these easy retrieval mechanisms is that analysis tools are standardized. Thus people transferred from one location to another will not require additional training to quickly and easily access relevant data**.**

Trusted source of data

By ensuring completeness and adequate QC of data before storing in EPINET and also by providing easy access, EPINET gradually becomes the defacto data source. The EPINET project ensured that data from the corporate master database supports easy connectivity to analysis and interpretation tools. Fig-7 shows utilization of production data of EPINET from a typical surveillance tool.

After the initial trust in data quality is built, one can focus on the usage aspect. As data can now be seen at a glance and delivered to the desktop by the flick of a button, even high-level managers can make a spot check of data trends on their own. For example, although production and reservoir engineers deliver suitable summary reports to the asset manager for making high level decisions for workover or EOR programs in a field, the asset manager can make quick spot checks on the data by himself, from his own desktop for more detailed information.

Beyond simple I/O

As there are two groups of users in the world of EPINET, Data Administrators remain engaged with data I/O, validation and QC aspects. On the other hand, data users who are domain experts, regularly think of ways to represent data from the EPINET store in meaningful ways that support their specific workflows. There are three predominant views of such technical data – surface view (maps), vertical view (Cross-section showing logs and markers , well profile, mudlog, well sketch etc.) and also X-Y view (ex: Production volume over time, Drilling time-vs-depth curve etc.). Fig-8 shows contour map of surface tops. As the mapping mechanism is flexible, the same technique can be used to generate a contour map of any parameter, such as pressure (Isobar), seismic time (Isochron), or geochemical data (TOC). Such maps play two important roles. Firstly, this becomes a QC tool as erroneous data becomes obvious when it is pictorially represented in context with other accurate reference data. Secondly, this can be used in a powerful way to represent important trends in the field, such as a bubble map representing production volume against a backdrop of reservoir pressure. Initial maps are best created by a combination of IT professionals (who know where data resides inside database and how best to extract and present the data) and domain experts (who know what kind of layers to put in a map to pass a message in a technical presentation, or to create a wall map for a group of people engaged in field study).

Business values of EPINET

The following sections touch upon some the aspects where EPINET has already delivered benefits.

Productivity gains

Trends show that most users access not only more data but also different data types than before, simply because they are so easily accessible. This is an important factor in the E&P world. Consider the case of Log Analyst interpreting the log of a new well. Thanks to existence of rich E&P technical data, the analyst can draw upon related information regarding the field, zone, core/cutting, drilling information (casing, cementation, ROP, Mud parameters), geochemistry of surrounding areas, and interpreted logs from neighbouring wells. These independent data help to constrain and corroborate his interpretation.

Some of the most active and important Geoscience projects in India have already experienced benefits and productivity gains as a direct consequence of the EPINET project by saving time in obtaining multiple data types and putting them to productive use to make better operational decisions and meet individual project deadlines.

Quality improvement

ONGC's premier R&D Institute KDMIPE, which is also the Nodal Centre for EPINET, uses a suite of integrated applications (from Commercial vendors) to successfully

predict reservoir lithology and fluid content from seismic data in onshore as well as deepwater areas. Before any drilling decision is made, all available data are used and significant time is spent to get the right subsurface description. Operationalization of EPINET systems have enhanced the quality of interpretations and significantly reduced the time spent by geoscientists throughout the company for prospect definition and reservoir characterization.

Efficiency

By migrating to a "shared earth model" environment, the company expects to improve the quality of its production prognoses significantly. The geological model building time will be reduced by a factor of 2 and model updating by as much as tenfold in a foreseeable future. It is also believed that the newly embraced technology and the new team workflows will enable the company to find and produce more hydrocarbons more cost effectively.

Promoting collaboration

With shared corporate database EPINET in hand, gone are the days when a geoscientist had to wait for his/her colleague to return from vacation to access key information inside his/her drawer or personal workstation. Data access is now system driven instead of being individual driven.

EPINET has transformed the culture of collaboration within the project teams and among other technological groups to the point that technical professionals have started talking about “our” work, instead of ”my” work or ”your” work.

The Road Ahead

ONGC is now fully geared up to derive greater value through use of all legacy as well as new E&P data in its quest for accelerated discovery of hydrocarbons.

As a result of relentless efforts made by EPINET teams, from now onwards a full spectrum of E&P data will be available to the users from single authenticated source. Geoscientists and engineers are acquiring new capabilities to work with multi-dimensional data, viz. 2D and 3D seismic, logs, well completions data, geochemical data, paleontological and palynological data, etc. Additional tools will need to be developed to help users deal with the multiplicity of data. These tools will allow geoscientists and engineers derive more value from the data, to better manage risk and uncertainty and further improve exploration and production results.

Acknowledgements:

The authors would like to thank both Oil and Natural Gas Corporation (India) and Schlumberger Information Solutions for their approval and cooperation in producing this paper. Special thanks are due to Mr. D.K. Pande, Director (Exploration) ONGC and Dr D.M. Kale, ED-Head KDMIPE, ONGC for their encouragement. The authors are also grateful to Mrs. H.B. Sharma of ONGC, Mrs. Susan Lundgren and Mrs. Jennifer E. Smith of Schlumberger Houston for helping in review and technical editing. The authors acknowledge the contribution of the EPINET team members of ONGC as well as Schlumberger towards the success of the project.

Nomenclature:

EBCDIC – Extended Binary-coded Decimal Interchange Code. The first part of SegY’s 3-part header, which is text based, uses this code.

EOR – Enhanced Oil Recovery

EPINET – Exploration and Production Information Network, a major Information Management project undertaken by ONGC

ONGC – Oil and Natural Gas Corporation Limited, India’s major National Oil Company. See www.ongcindia.com

QC – Quality Control (of data)

ROP – Rate of penetration (linked to drilling of well)

SegY – Format for storing seismic data. See www.seg.org

SIS – Schlumberger Information Solutions. See www.sis.slb.com

References:

1. Mittal, P. K.; “Setting up of Exploration & Production Information Network in Oil & Natural Gas Corporation”, paper presented at 6th International Petroleum Conference (PETROTECH) in New Delhi, India, 2005.
2. Kumar, N and Sutich, D.: EPINET newsletters and other project documents, 2004-2005.
3. Various project team members: EPINET task-force recommendations, 2004-2005.

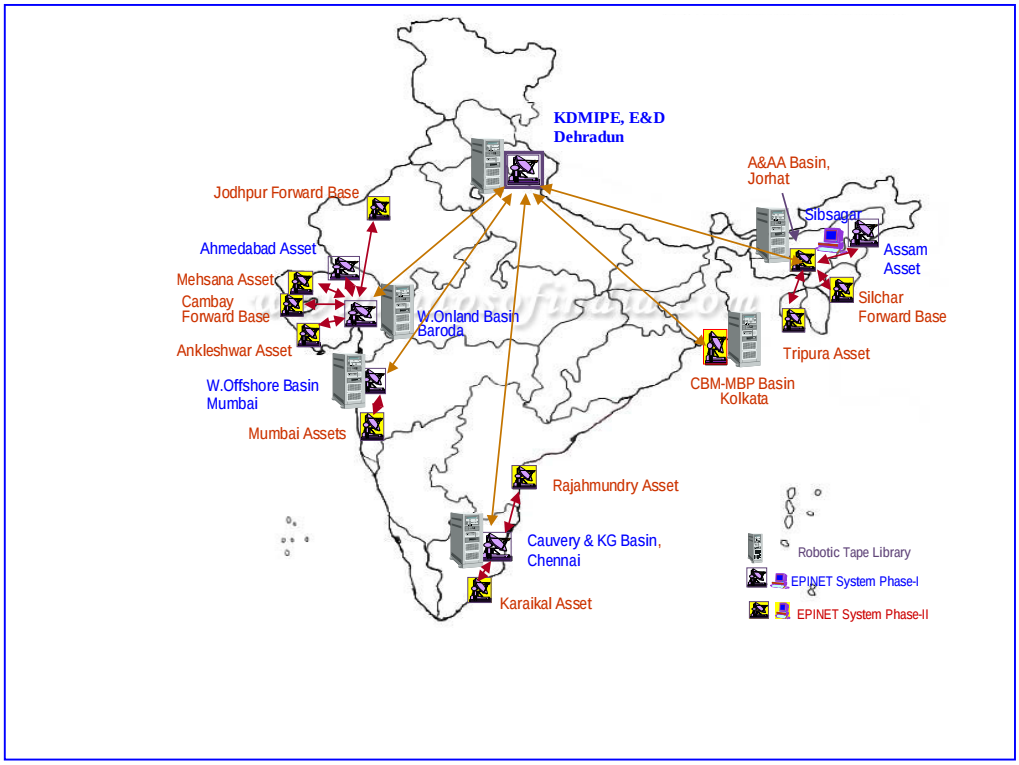

Figure 2 : EPINET sites across the country

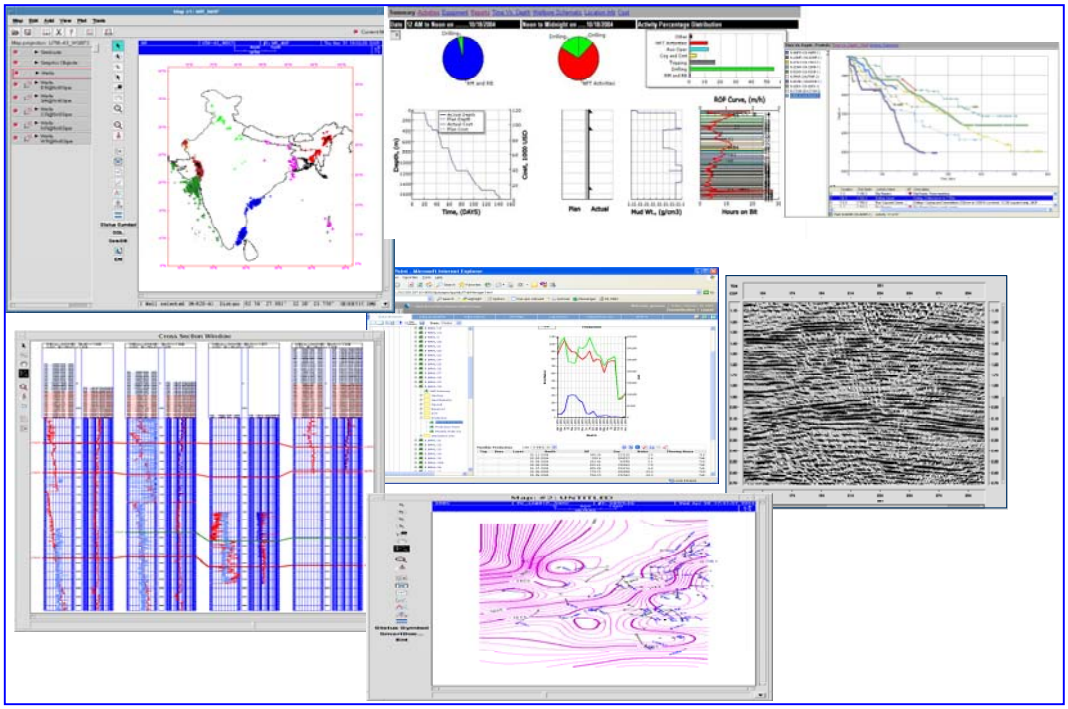

Figure 3 : EPINET results, at a glance

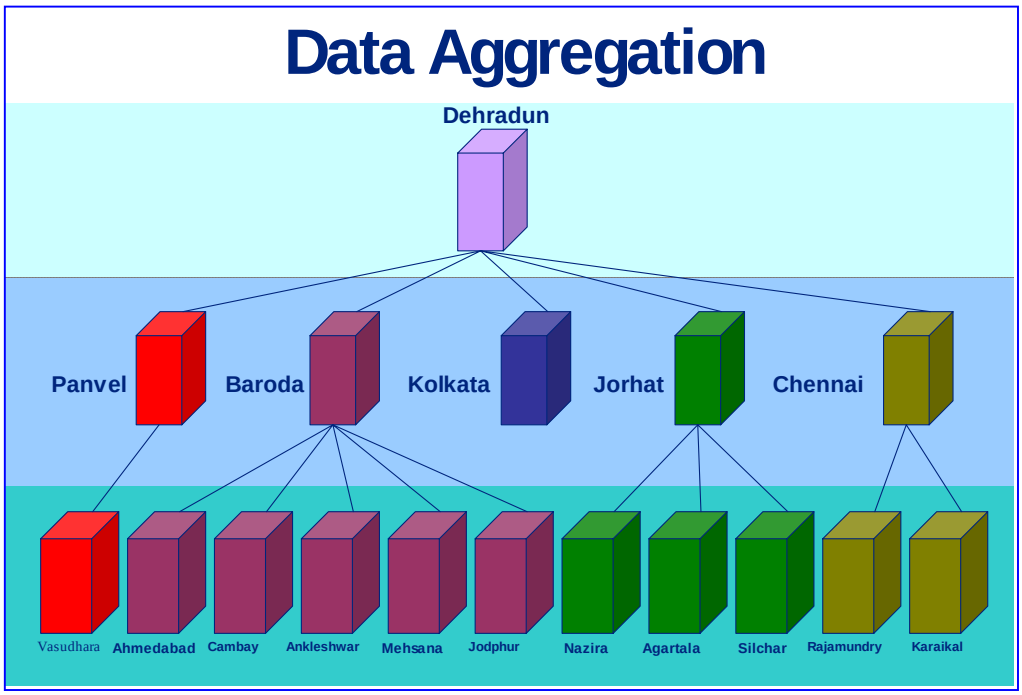

Figure 4 : Data aggregation showing movement along pyramidal structure

PAR_NAME	DATA_TYPE	OFFSET	LENGTH	TEXT
CLIENT_COMPANY	EBCDIC	4	20	CLIENT :
SURVEY	EBCDIC	46	20	SURVEY :
LINE_NAME	EBCDIC	84	30	LINE :
AREA	EBCDIC	126	20	AREA :
TAPE_NUMBER	EBCDIC	164	20	REEL NO :
BLOCK	EBCDIC	206	20	BLOCK :
SHOT_POINTS	EBCDIC	244	30	SHOTPOINTS :
CDPS	EBCDIC	324	30	CDPS :
INTERNAL_DATA_TYPE	EBCDIC	366	10	DATA TYPE :
REF_REC_LENGTH	EBCDIC	404	15	RECORD LENGTH:
INTERNAL_FORMAT	EBCDIC	446	10	FORMAT :
REF_SAMPLE_RATE	EBCDIC	484	15	SAMPLE RATE :
NO_OF_SAMPLES	EBCDIC	526	10	NO OF SAMPLES:
PROCESSED_BY	EBCDIC	564	20	PROCESSED BY :
PROC_DATE	EBCDIC	606	15	DATE :
CDP_FIRST_SHOT	EBCDIC	686	10	CDP AT FIRST SHOTPOINT:
RECORDED_BY	EBCDIC	811	20	RECORDED BY :
RECORDED_DATE	EBCDIC	841	15	DATE :
REC_FORMAT	EBCDIC	891	5	FORMAT :
REC_REC_LENGTH	EBCDIC	921	10	RECORD LENGTH :
REC_SAMPLE_INT	EBCDIC	971	10	SAMPLE RATE :
NO_OF_GROUPS	EBCDIC	1001	10	NO OF GROUPS :
REF_SHOTPOINT_INTERVAL	EBCDIC	1051	15	SHOT INTERVAL:
REF_GROUP_INTERVAL	EBCDIC	1081	15	GROUP INTERVAL:
REF_OFFSET	EBCDIC	1131	10	OFFSET :
GROUP_LENGTH	EBCDIC	1161	15	GROUP LENGTH :
DIR	EBCDIC	1211	10	DIRECTION :
PROC_HIST	EBCDIC	1220	0	
FREE_TEXT1	EBCDIC	1283	76	

Figure 5 : EBCDIC header template SegY file

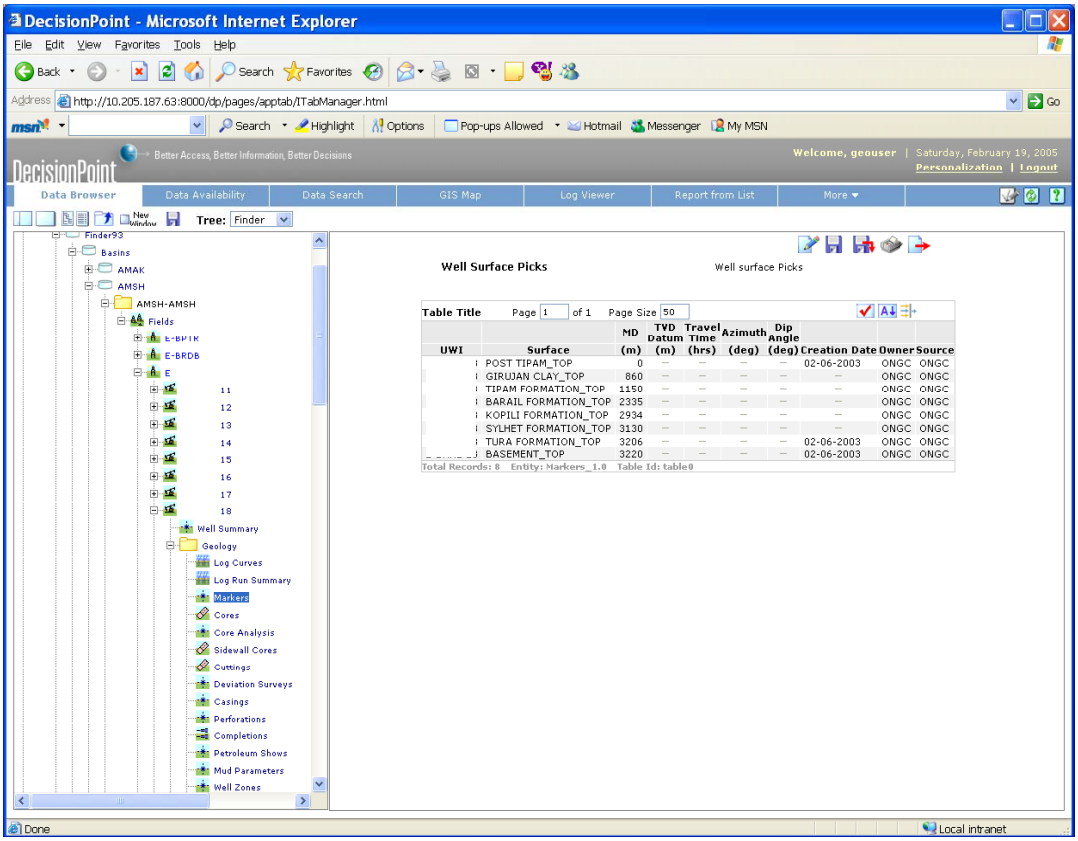

Figure 6 : Web access to E&P data similar to Windows Explorer

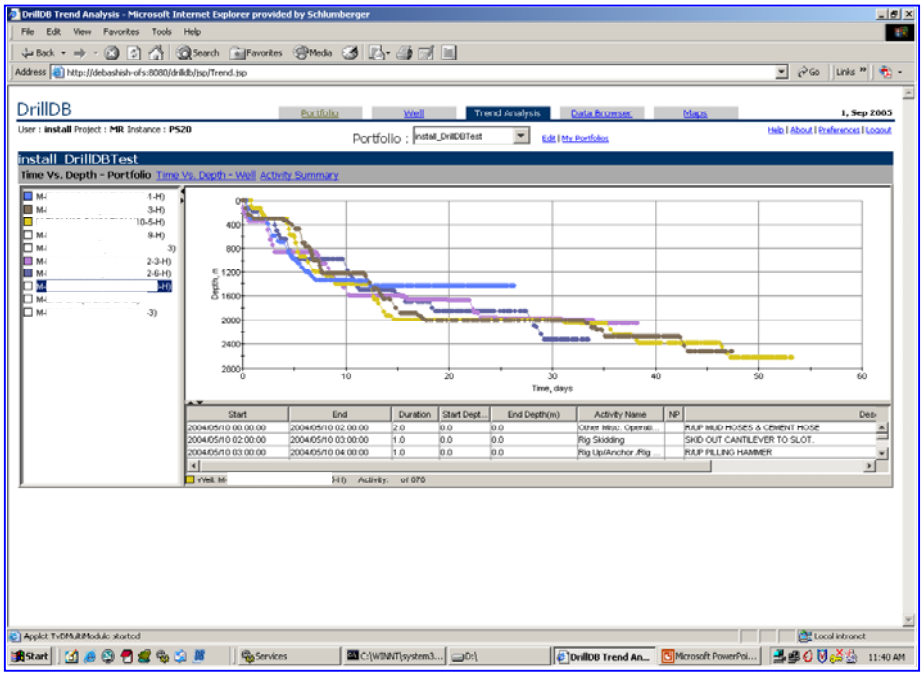

Figure 7 : Multi-well Drilling information time-depth

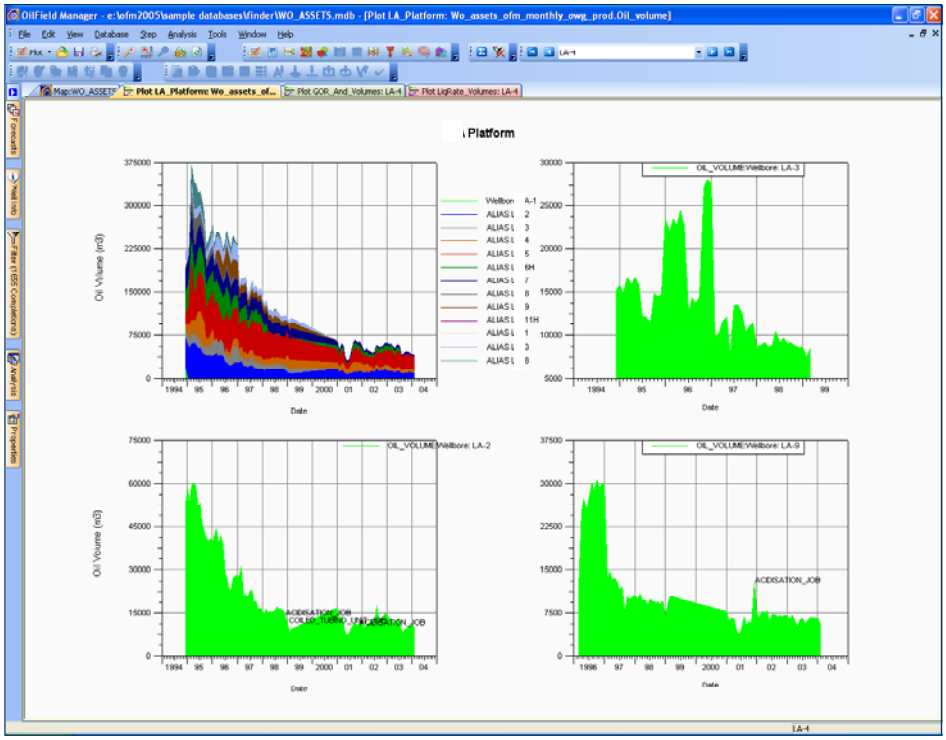

Figure 8 : EPINET data utilized through Production data analysis tool

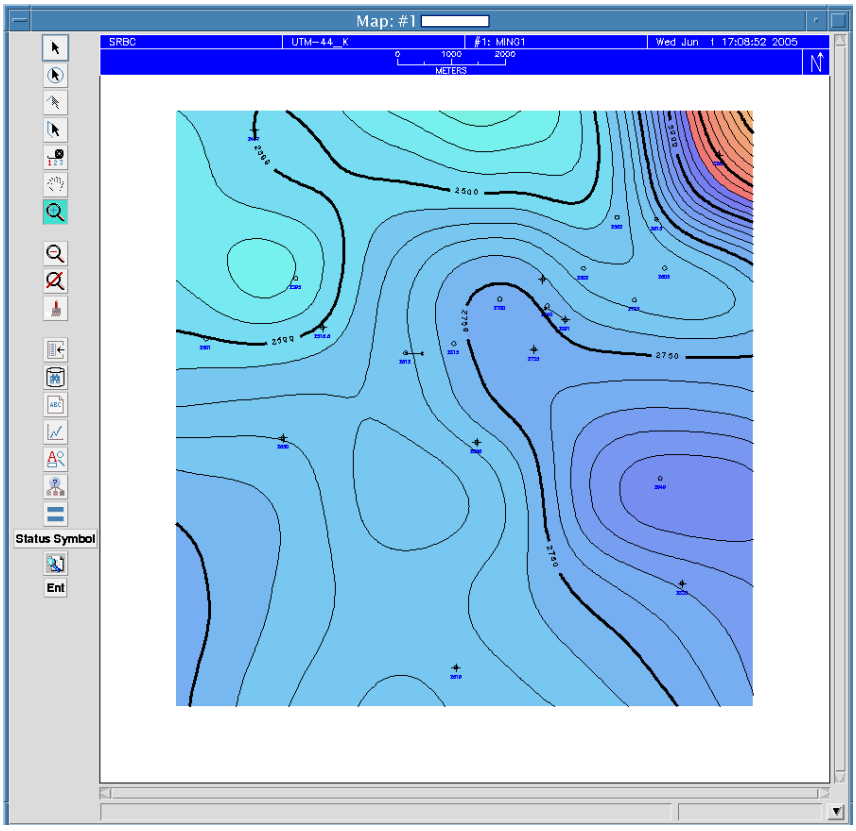

Figure 9 : Contour map showing surface top