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EPINET – G&G Information Resource Management in ONGC

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Summary

The paper explores the cardinal need for an organizational transformation is a real-time availability of accurate information, generating shared knowledge, transforming human and structural system for improved timely decision making, thus ensuring a high performance in Exploration & Production (E&P) activities of Oil & Natural Gas Corporation (ONGC), a leading innovative, continually learning and improving corporate in the world has been always been acquiring and assimilating contemporary technologies to operate at global efficiency and has in the process developed a rich knowledge database across the organization. In its continued pursuit of excellence, ONGC took an early cognizance of the fact that data management & information are vital to modern E&P businesses a decision was made to set up an enterprise - wide Exploration & Production Information Network (EPINET) using industry standard 'FINDER' software of the Geo-Quest under LAN/WAN (Local Area Networking / Wide Area Networking) environment.

Thus ***Exploration & Production Information Network (EPINET) has emerged as one source of information*** *by collecting the data of different activities i.e. Seismic, drilling, well, logging & production for achieving one goal of the organization for development of an E&P company like ONGC. The project is intended to establish an organization wide dynamic database having GIS features and Web capabilities, to loosely interconnect different data stores located at geographically diversified locations. The project EPINET Phase-I was initiated & installed IT infrastructure like computer systems and data management software were acquired under LAN/WAN environment at KDMIPE, Dehradun, Baroda, Chennai, Mumbai, Nazira and Ahmedabad. Phase – II of this project is designed to ensure complete execution and successful operationalization. Oil & Natural Gas Corporation (ONGC) carried out a comprehensive work-study under Phase-I to identify Phase-II job elements and the recommendations were further validated by the consultant i.e. Petro-technical Open Standard Consortium (POSC). In Phase-II installation of Hardware & Software (H/W & S/W) at Assets/Basins/Forward Bases completed and migration of legacy Exploration & Production (E&P) data (Managed only physical asset metadata in phase – II at Dehradun) into Exploration & Production Information Network (EPINET) system at basins, assets and other work centres started. The data types given emphasis in Phase-II are drilling, Seismic trace data, production and reservoir along with the remaining Phase-I data.*

It is expected that with the full implementation of the Exploration & Production Information Network (EPINET) facility the Geo-scientists and engineers working on a "Common & Unified Data Base", will have instant access to every domains raw data, interim and final results. It is aimed to improve data / information communication and enhance Exploration & Production (E&P) work flow integration leaving less scope for assumptions, bring out more realistic and shared earth model versions.

The paper includes the presentation of overview of data management of Exploration & Production (E&P) Information Network (EPINET) and KG - PG basin activity derived from Exploration & Production Information Network (EPINET) database, storage management, tools employed thereof and production business strategic opportunities of Oil & Natural Gas Corporation (ONGC) an Exploration & Production (E&P) company of Maharatna Status.

Introduction

ONGC has been pioneering in contemporary technologies to operate with global efficiency. In this continued pursuit ONGC took an early cognizance of the fact that data, knowledge & information are vital to modern E&P businesses. The extensive use of Information Technology in areas like scientific computing, data acquisition, telecommunication, process control, business computing has helped in streamlining systems, policies & business,

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processes to become an effective, fast moving global E&P player. ONGC, an integrated National Oil Company, has undertaken EPINET project to design and set up a web enabled industry standard data management system for Geophysical and other related E&P data, for use by Geophysicists as well as all other geoscientists and engineers, across the company. EPINET project is intended to enable multiple users to use all data and information, from their own workplace concurrently, in order to make speedy technical and business decisions. By implementing the EPINET facility at all Assets, Basins, Forward Bases as well as major Institutes, the entire E&P data including 2D and 3D, Seismic, VSP, well log data and drilling data is made available online to remote users. This paper summarizes ONGC data management strategies and initiatives for harnessing the state-of-art technology, challenges faced, achievements, the lessons learned, benefits derived and future plans.

ONGC recognized the need for properly storing E&P data, non-electronic physical assets (e.g. Technical reports, Tapes, Films and Prints), all of which were usually kept in unsecured, unconditioned and disparate environments, in the nineties. To retrieve log data, ONGC had resorted to manual indexing. This caused several problems including loss of data, difficulty in accessing data, and inaccuracy of the stored data due to lack of validation. Additionally, digital data was not available for all wells/surveys. Even for more recent wells, where digital data was available, there were discrepancies. With no central and commonly accessible data store in place, different teams managed data differently as per individual preferences, in different media, formats and platforms. The situation was further complicated by the proliferation of multiple versions of unedited and invalidated data. One of the biggest challenges was not only storing and cataloguing data involving drilling and the production activities, well logs and their related prints and tapes, but also validating and providing the data for the end users to gain their trust and confidence. ONGC wanted to modernize its E&P data flow, and build an updated and reliable central data repository that could serve the whole exploration and production E&P community in the company.

In order to meet the above challenges, ONGC launched a major enterprise-wide change initiative called EPINET project, focussed on optimization of human resources, reengineering of processes, deployment of new software and hardware technology and proper management of validated data. It envisages the creation of a hierarchy of corporate, regional and local databases networked in a seamless fashion. The project was intended to establish an organization-wide integrated, online database having GIS features and Web capabilities to logically interconnect different data stores located at geographically diversified locations.

Data without Management

In early days before computer technology set in, the data was stored as paper records. Exploration and Production (E&P) data stored in file cabinets bulging with files, or map rooms crowded with an accumulation of maps since many years. It was very difficult to find the data that is required. Data in remote locations was often not available as it was either not properly filed or lost. The data with multiple versions often exists, with lot of ambiguity as to which version was valid.

Data Stored as Paper Records

During the course of time the digital processing and storage techniques were made available, it was therefore possible to store data on disks or tapes. Thus it became a thought provoking & driven to exponential growth in the use of digital storage space. Prior to this the industry had accumulated mountains of tapes and disk files placed on computer architecture in every conceivable format. Part of the problem was that each software application required its own database in its own format, incompatible with most other databases.

Data Management 1990

With the passage of time, data versions moved to multiply and mutate, so that the well and seismic data stored for one application might be different from the data stored for another application. It was entirely possible to drill a well on a location where a dry hole already existed, or shoot a seismic line in the same location as an existing line. There was no dependable way to prove that your data was valid. It has been estimated that the average geological and geophysical interpreter spends up to 50% of their time looking for data. From a corporate perspective, this statistic represents inefficiency that was simply unacceptable. A need was felt that some change is required for efficient data management.

Industry Trends

In recent past, several trends within the E&P industry underwent rapid changes moving forward to derive technological mileage and to ensure optimized operation in the value chain, ONGC embarked on an ever accelerating fashion. Some of the key trends that have impacted data management are:

- The pressures to increase efficiency and lower finding and producing costs.
- Corporations are concentrating on core competence and outsourcing non-core functions.
- Vendors must "fill the gap" with commercial products and management solutions.
- Corporations are re-organizing into "business units" or "asset teams".
- There is a move from proprietary "closed" systems to off-the-shelf "open" systems.
- There is a strong push for standards and integration such as Energetics, formerly termed as Petro-technical POSC and PPDM.
- There is a growing recognition that Information Technology is not a solution by itself.

Database Standards

The Petroleum industry has developed a set of standards to guide companies and vendors in developing software products. The goal is to increase integration between products and to minimize information management problems. Two standards are commonly used: PPDM and Energistics Standarad.

Public Petroleum Data Model (PPDM) Standard

PPDM is a data model developed by a consortium of Petroleum industry companies. This data model was established to leverage Petroleum company's existing investments in relational database technology. Finder was one of the first large scale applications to use the PPDM. Finder implements its model with Oracle database technology. Although still compliant with the basic PPDM model, Finder has been extended in a number of areas to meet the expanding business needs of users.

The Energistics Standard

The Petroleum industry has been searching for a software standard that would fully describe its business and allow all companies and vendors to efficiently produce integrated software. In this regard POSC was emerged. Now the name has been changed to Energistics, a non-profit corporation, being the energy standards resource centre is dedicated for facilitating integrated business processes and computing technology for E&P segment (Fig.1) of the international petroleum industry.

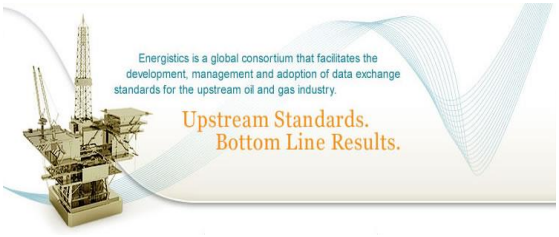

Fig.: 1

Geo-Frame is the industry's first commercial, Energistics-compliant software. It provides a common Oracle project database that both Geo-Quest and other applications can "plug" into and a set of utilities that are shared by all Geo-Frame applications.

New, fast machines and improvements in database technology emerged to make it possible to converge Public Petroleum Data Model (PPDM) based technology towards Energistics technology. One significant component of the finder, the Production extension, has evolved toward compliance with the Energistics data model. ONGC in late 1990's decided to implement the recent advancements of the web based E&P information technology into its upcoming data management systems.

The new implementation plan was aimed at making available all information pertaining to an area-including the work previously done by archiving historical analysis to business users. During past five decades, ONGC has carried out extensive exploration, drilling and production activities in the Indian sedimentary basins and over the time has acquired enormous volume of geological, geophysical, logging and engineering data. Like other companies, ONGC initiated data management activities way back in 1976, by developing well information system on IBM-370 at KDMIPE.

The data management activities got a boost when VAX-3400 computer system along with RDBMS software was commissioned at KDMIPE in 1991. Furthermore, other systems also emerged at different work centres of ONGC to cater to the data management needs. These in-house database systems were developed using different types of formats and platforms. Eventually, in-house database systems were felt to be inadequate and required to be replaced with industry standard solution. In view of ever increasing business challenges, ONGC has defined very ambitious corporate goals, it is committed to raise enhanced oil recovery factor to an average of 40 per cent from existing fields and to double reserve accretion by the year 2020.

EPINET – An Overview

Over the past few years E&P Information technology has incrementally made significant strides in the work flow process dynamics of upstream petroleum industry. There is an increasing desire and thrust for long-term preservation of data assets by building up corporate E&P information and knowledge networks to seek business decisions. Meanwhile the corporate world has begun to recognize that data is a highly valuable asset. Internet, Intranet and web-based technologies are promising a single interface across multiple computer platforms; thereby promising better, cross discipline, concurrent usage of data & therefore EPINET project (Fig.2) was set up.

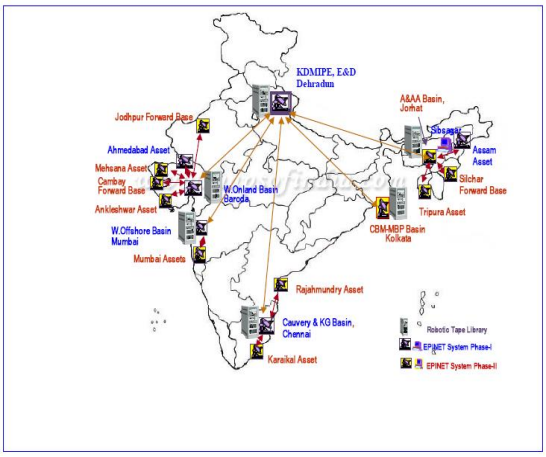

Fig.: 2 EPINET Sites across the country

All these changes pushed industries towards web GIS based industry standard/commercial solutions and thereby replacing in-house developed legacy databases in ONGC.

The strategic planning of EPINET project was initiated with the following key technical objectives:

- Develop a corporate-level data store for company's E&P data.
- Implement a project-level database/integration platform at all Assets, Basins, Forward Bases and Corporate centres.
- Standardize new procedures, standards and nomenclatures for subsurface and surface data management and quality assurance associated with all database systems.

Experimental

ONGC has opted for Geo-Quest's Finder E&P data management technology to manage vast volume of its E&P data asset. The Finder, an integrated data management system, is an advanced yet easy system for capturing, storing, archiving, accessing and delivering the corporate E&P data. Under the project EPINET the Finder technology provides a set of databases and application tools to address specific E&P data management needs. Collectively, these tools are known as the Finder Data Management System. The main part of this system consists of Finder Basic and its archival extensions i.e. SeisDB, LogDB and AssetDB etc.

EPINET Project - Phase - I:

ONGC started a holistic attempt for EPINET project in a Phased manner. Phase - I of the project was initiated in May 1999 and completed in June 2000. In Phase - I, computer systems and data management software were acquired and installed under LAN/WAN environment at KDMIPE with backup system at E&D Dehradun., Baroda, Chennai, Mumbai, Nazira and Ahmedabad. ONGC personnel were trained in the use of the EPINET Systems, and approximately 25% of ONGC's E&P data were migrated into the new systems. The main data types planned to be managed during EPINET Phase - I, were mainly well completion, Geo-Laboratory, Seismic Navigation, spliced Log Traces, Field Reservoir & Production.

EPINET Project - Phase - II:

Phase - II plan was augmented through a contract between ONGC and Geo-Quest Systems B.V. (GSBV) on 29th March 2004 and as per the MOU planned targets were achieved by the end of March 2005.In Phase - II of the project ONGC personnel were trained through special tailor made modules on Secured Data Access, Spread Sheet Loaders, SAM - FS software, DrillDB Reports and Geo-frame Petro-physics software. Hardware & Software were installed at Assets/Basins/Forward Bases, and successful implementation of EPINET facility was ensured. E&P data already managed on Basin servers was segregated and installed at respective Asset/Forward Base sites, and E&P Data flow mechanism from Assets to Basins and Basins to Corporate server was established. Further, replication process between KDMIPE server and E&D Directorate server was also established.

To ensure seamless flow of current data in the minimum possible time from the data generating centre to the concerned EPINET site, work flows were designed and implemented. The pictorial diagram of business value of EPINET is shown in fig.3. Currently EPINET is managing current as well as legacy E&P data to provide more and more intrinsic value to the Geoscientists, as well as top management by making the desired data available in the quickest possible manner.

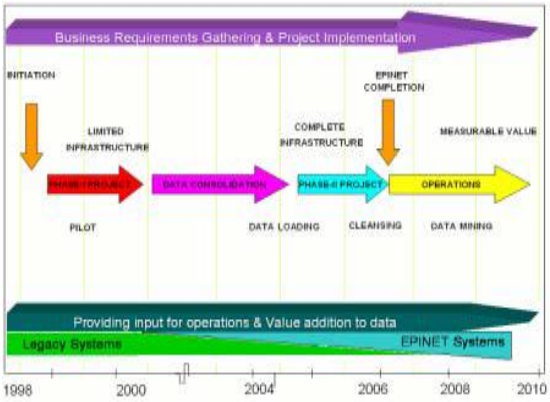

Fig.: 3 Obtaining Value from EPINET

Methodology

The key business function of Oil and Natural Gas Corporation (ONGC) is to explore and exploit hydrocarbons in an efficient, repeatable and sustainable manner. The behaviour of E&P data model and current data management solution must respond to these business needs. In these lines ONGC had decided to migrate and manage the full spectrum of E&P data into a single homogeneous data model under EPINET project. The EPINET has SeisDB & LogDB for voluminous seismic and log data management respectively while the entire well data, drilling and production data is managed in 'Finder' databank. With the experience of sample E&P data and subsequent loading of all data classes in the Finder Data Model at all ONGC sites under EPINET, the task of initiating and building current E&P data management framework looked feasible and achievable.

There are two ways in which the data can be loaded into Finder E&P databank of ONGC. Finder has a number of forms for different activities, which can be used for data loading and viewing. Alternatively, if data is in well - structured format like Spread sheet, an XML based SSL can be developed and can be used for bulk data loading. XML based Spread sheet loaders are very convenient tool for data loading using a spread sheet interface. The pre-defined business objects are an XML file which maps the spread sheet columns to database attributes using updatable views. Then triggers are fired on these views to load the values to the database. A pre-defined business object enables to make equivalence between a spread sheet column and a database attribute. The business object will then manage the actual distribution of the data inside the data model. Data loading through SSL does not require the knowledge of underlying data model from users' point of view. The following methodology was adopted for current well data management from drill sites to base to Finder:

- The data to be captured activity wise at source, i.e., drill site in Spread sheets by geology, drilling, logging and chemistry personnel. Microsoft Excel was chosen as Spread sheet.
- Data to be communicated to Base Office through existing network, means and practices.
- Data to be validated and authenticated at base office by data owners.
- Data to be loaded into EPINET.

The importance of methodology lies in the fact that existing workflows / practices are not affected. Only data is captured in standardized formats avoiding multiple data entry.

The Finder technology supports a broad variety of technical E&P data types, generated during the different business processes of any E&P company i.e. General well data, Geological data, Well log curves, Production data, Cultural, geopolitical, and graphical data, Lease and concession data, Seismic 2D / 3D navigation data, any gridded data, original log curves, Seismic 2D / 3D trace data, physical assets etc.

Work Processes

The E&P work processes are primarily designed to generate and utilize the technical information necessary to make business decisions. Changing work culture and mind set is much more subtle and difficult to manage than changing technology. To develop and optimize more efficient work flows using integrated software applications, hardware technology and common project databases, ONGC created a "Virtual" work-force of data managers and technical experts involving the diverse E&P disciplines and remote sites. In addition to the management team of EPINET Data Managers, Domain Expert Teams named as "Task Forces" were formulated for each of the disciplines: Geology, Seismic, Production Engineering, Reservoir Engineering, Drilling, Logging, Geo-lab and Software. Each discipline team had experts from appropriate Basins, Assets or Institutes. The objectives of the teams were clearly defined and the teams were to deliberate and recommend on the technical requirements for data capture, standardization of nomenclatures, UOM, customization of input and output forms and reports in their respective areas. ONGC had to adopt a common model of data management.

OPU Model

ONGC has decided that data will be Owned, Populated & Used (OPU) by the Assets, Basins and Forward Bases who generate the data and who will also manage their data by themselves. EPINET data management project teams are only the custodians of data. An asset-focused distributed data management organization, though controlled centrally, has been adopted by ONGC. New workflows and cross-discipline methodologies have been documented and made widely available via standard Web browsers on ONGC's intranet.

EPINET IT infrastructure

Hardware	:	Sun Microsystems
Operating System (OS)	:	Sun Solaris 8
Database Management System (DBMS)	:	RDBMS Oracle 9i
E&P DM Technology	:	Finder Data Management System, Logdb, Seisdb.

EPINET Data Types

Well Data: General Well data reported in well completion reports (i.e. well header information, core details, stratigraphy, well completion, production testing, reservoir, rock / fluid sample analysis results etc.) pertaining to over 10,000 wells are being managed in Finder master database. Earlier, these data sets were managed in multiple independent repositories on various platforms and locations. The data sets were cleaned, standardized and once uniform naming conventions were applied, and these were moved to logically interconnected tables managed through ORACLE RDBMS in Finder. Mapping of common entities (e.g. well name, core id, layer name etc.) with different data sets prevailing at diverse geographic locations was a real challenge, but this was successfully accomplished by achieving standardization through domain-specific task forces.

Log Data: ONGC, the largest operator of India, had accumulated a tremendous amount of log data in its 50 years of operation. The number of well log tapes reached into thousands, storing hundreds of thousands of well log curves. Although it is considered a valuable national asset, this huge volume of data was becoming unmanageable and the desired value could not be obtained by ONGC. ONGC is managing raw logs as well as spliced, edited and ready to use merged logs by utilizing LogDB and Finder master database technologies of Schlumberger Solutions Private Ltd.

Seismic Data: Most of the seismic navigation data was managed during Phase-I and post Phase-I activities of the project. However, entire 2D / 3D seismic stack and migrated data was covered in Phase-II and managed by utilizing SeisDB software from the solution provider.

Results & Discussion

Data loading:

ONGC adopted the policy of loading legacy SegY for seismic data into the data base from recent to past. However, any required data is loaded on priority as per the user's requirement. The current data is being loaded on highest priority. There are a total of about 750 2D surveys and 260 3D surveys to be managed and uniformity in nomenclatures and procedures are to be adhered to. The survey names and line names have been standardized. The survey name of a maximum permissible 20 characters consist of codes for Basins, whether onshore/offshore, 2D or 3D, Block and state codes. The line name can be of maximum 16 characters and consists of state code, investigation no. and line no. The state code required for onshore survey name has also been standardized.

The most important part in standardization is that of SEG Y header parameters for EBCDIC header for 2D and 3D data (Tables 1 and 2).

EBCDIC Header Format for 2D Data

```
C 1 CLIENT:  XXXXXXXXXXXXXXXX                    2D SEISMIC DATA
C 2 LINE:                    SURVEY: xxxxxxxxxxxxxxxx   AREA:xxxxxxxxxxxxxxxxxx
C 3 SPHEROID: EVEREST75       PROJECTION:UTM-44          CM : 81      CP2: XX
C 4 FSP:      74              IS AT  LAT: 11 12 18.12 N  LON: 79 30 29.01 E
C 5 LSP:    1088              IS AT  LAT: 11 01 26.84 N  LON: 79 20 42.52 E
C 6 FCDP:     1               SP ON FCDP:    1   LCDP:  1088  SP ON LCDP:  1088
C 7 ADDITIONAL SP CDP RELATION PAIRS FOR CROOKED PROFILE (OTHERWISE BLANK)
C 8 ADDITIONAL SP CDP RELATION PAIRS FOR CROOKED PROFILE (OTHERWISE BLANK)
C 9 BLANK
C10 ACQUISITION PARAMETERS
C11 RECORDING YEAR: 2004    AGENCY:ONGC                  VKSSKL/PARTY:GP-29
C12 SYSTEM:DFS-IV           REC FORMAT:SEG-B             LOW/HIGHCUT:  8/128 HZ
C13 NO OF CHANNELS: 96      FOLD:  48                    SOURCE: VIBROSEIS
C14 SAMPLE INTERVAL: 2MS    REC LENGTH: 5000 MS          REC START TIME:  0MS
C15 SHOT INTERVAL: 100 M    GROUP INTERVAL: 100 M        NEAR OFFSET: 200 M
C16 LAYOUT:SPLITSPREAD      BACK CHANNELS:  72           FORWARD CHANNELS: 24
C17 ENTER ADDITIONAL INFORMATION HERE
C18 ENTER ADDITIONAL INFORMATION HERE
C19 BLANK
C20 PROCESSING PARAMETERS  AGENCY: RCC, CHENNAI, ONGC  BASIC/REPROCESSING
C21 PROCESSING STEPS
C22 PROCESSING STEPS
C23 PROCESSING STEPS
C24 PROCESSING STEPS
C25 PROCESSING STEPS
C26 PROCESSING STEPS
C27 PROCESSING STEPS
C28 PROCESSING STEPS
C29 PROCESSING STEPS
C30 PROCESSING STEPS
C31 PROCESSING STEPS
C32 PROCESSING STEPS
C33 PROCESSING STEPS
C34 PROCESSING STEPS
C35 BLANK
C36 PROCESSED OUTPUT STORED IN THIS TAPE:DMOSTK/MISTK/PSTM/PSDM
C37 DOMAIN:TIME/DEPTH       REC LENGTH: 4000 MS          SAMPLE INTERVAL: 4 MS
C38 ADDITIONAL INFORMATION
C39 BLANK
C40 END EBCDIC

REMARKS:
1.All text fields are left justified and numeric values are right justified as
shown
2.C1 TO C6,( also C7 & C8 for Crooked Lines ) & C36 AND 37 ARE MANDATORY FOR
LOADING OLD DATA
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Table 1: EBCDIC header - 2D Seismic data

EBCDIC Header Format for 2D Data

```
C 1 CLIENT: §§§§§§§§                             2D SEISMIC DATA
C 2 LINE:   1A                SURVEY: xxxxxxxxxxxxxxxx   AREA:xxxxxxxxxxxxxxxxxx
C 3 SPHEROID: EVEREST75       PROJECTION:UTM-44          CM : 81      CP2: XX
C 4 FSP:      74              IS AT  LAT: 11 12 18.12 N  LON: 79 30 29.01 E
C 5 LSP:    1088              IS AT  LAT: 11 01 26.84 N  LON: 79 20 42.52 E
C 6 FCDP:     1               SP ON FCDP:    1   LCDP:  1088  SP ON LCDP:  1088
C 7 ADDITIONAL SP CDP RELATION PAIRS FOR CROOKED PROFILE (OTHERWISE BLANK)
C 8 ADDITIONAL SP CDP RELATION PAIRS FOR CROOKED PROFILE (OTHERWISE BLANK)
C 9 BLANK
C10 ACQUISITION PARAMETERS
C11 RECORDING YEAR: 2004    AGENCY:ONGC                  VKSSKL/PARTY:GP-29
C12 SYSTEM:DFS-IV           REC FORMAT:SEG-B             LOW/HIGHCUT:  8/128 HZ
C13 NO OF CHANNELS: 96      FOLD:  48                    SOURCE: VIBROSEIS
C14 SAMPLE INTERVAL: 2MS    REC LENGTH: 5000 MS          REC START TIME:  0MS
C15 SHOT INTERVAL: 100 M    GROUP INTERVAL: 100 M        NEAR OFFSET: 200 M
C16 LAYOUT:SPLITSPREAD      BACK CHANNELS:  72           FORWARD CHANNELS: 24
C17 ENTER ADDITIONAL INFORMATION HERE
C18 ENTER ADDITIONAL INFORMATION HERE
C19 BLANK
C20 PROCESSING PARAMETERS  AGENCY: RCC, CHENNAI, ONGC  BASIC/REPROCESSING
C21 PROCESSING STEPS
C22 PROCESSING STEPS
C23 PROCESSING STEPS
C24 PROCESSING STEPS
C25 PROCESSING STEPS
C26 PROCESSING STEPS
C27 PROCESSING STEPS
C28 PROCESSING STEPS
C29 PROCESSING STEPS
C30 PROCESSING STEPS
C31 PROCESSING STEPS
C32 PROCESSING STEPS
C33 PROCESSING STEPS
C34 PROCESSING STEPS
C35 BLANK
C36 PROCESSED OUTPUT STORED IN THIS TAPE:DMOSTK/MISTK/PSTM/PSDM
C37 DOMAIN:TIME/DEPTH       REC LENGTH: 4000 MS          SAMPLE INTERVAL: 4 MS
C38 ADDITIONAL INFORMATION
C39 BLANK
C40 END EBCDIC

REMARKS:
1.All text fields are left justified and numeric values are right justified as
shown
2.C1 TO C6,( also C7 & C8 for Crooked Lines ) & C36 AND 37 ARE MANDATORY FOR
LOADING OLD DATA
```

Table 2: EBCDIC header – 3DSeismic data

For 2D data, separate software (epinetsgycpy2D) is used to edit the 2D header and put the header parameters in standardized format while for editing the headers in 3D data, epinetsgycopy3D program is used. The edited and finalized headers can be conveniently viewed through SeisDB (Fig 4 & Fig 5).

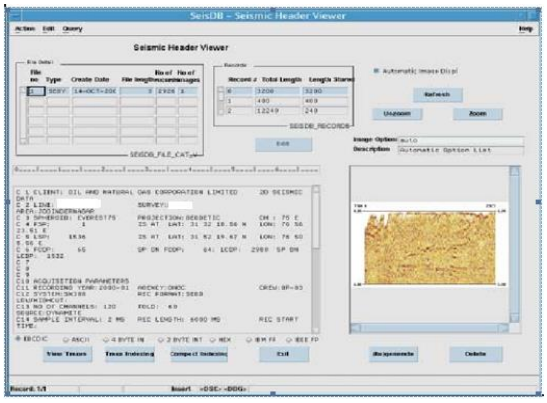


Fig.:4 Seismic header Viewer in SeisDB

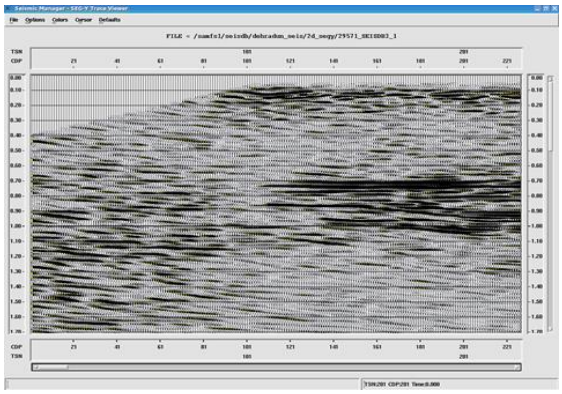


Fig.: 5 SEG-Y Trace Viewer

Some of the parameters of EBCDIC headers have been made mandatory for loading the data into EPINET System. Further all the processing centres have been requested to provide the processed data in standard header format henceforth. Editing is to be meticulously carried out before the data can be loaded into the data base.

Drilling Data

ONGC completed around 10,000 exploratory and development wells as on date. The daily drilling reports and associated data sets are available at different sites in different formats and in different media. Some of the data is also managed through in-house developed software Drillmis system in IDT, whereas current data is captured through another project by using a module of ICE. The drilling data management module DrillDB provides a single authenticated source of drilling data to drilling engineers (Fig.6 A & Fig. 6 B). Considerable data entry work is involved in digitizing the DDRs, which are in paper form. Once all data is managed users will be able to browse drilling data in textual or graphical forms under integrated G&G environment through web at their work sites by utilizing DrillDB software of Schlumberger Solutions Private Ltd.

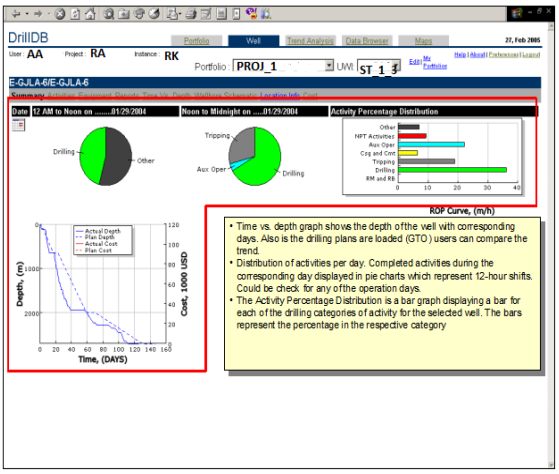


Fig.: 6 (A) Portfolio Section in DrillDB

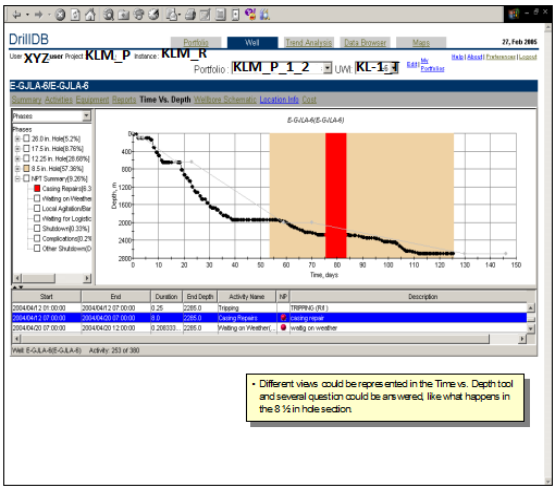


Fig.: 6 (B) Well Activities Section in DrillDB

Production Data

ONGC is managing different kinds of production data by using Finder at the EPINET sites. The common production data types are production volumes, work over histories, Well stimulation jobs, Pipe lines, Water injection, Artificial lift, Gas utilization, Value added products, Fluid characteristics, etc. Production engineers are deriving many benefits through the systematic storage of data in EPINET.

Production Data Model Process

- Production data in finder is managed through Production extension data model (PDM).

- An integral component of the main Finder Database.

Production processes include

- Well testing, well operations, well component facilities, surface production facilities, production history & measuring fluid sample properties etc. Layer wise production & well wise production are shown in fig.7 & fig.8 respectively.

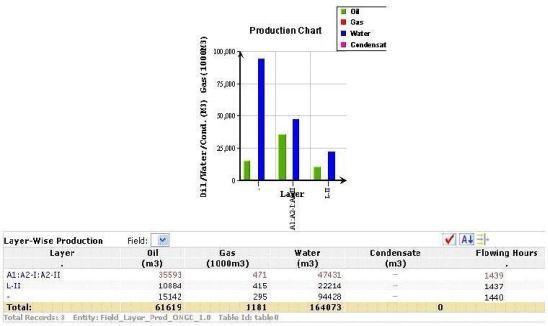


Fig.: 7 Layer wise Production

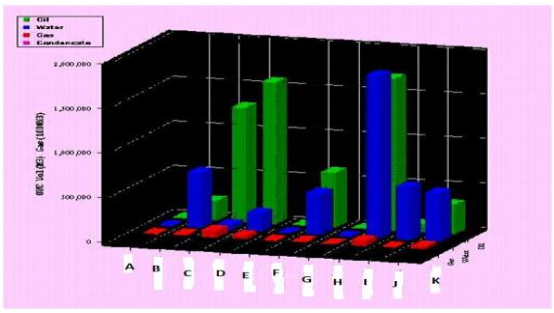
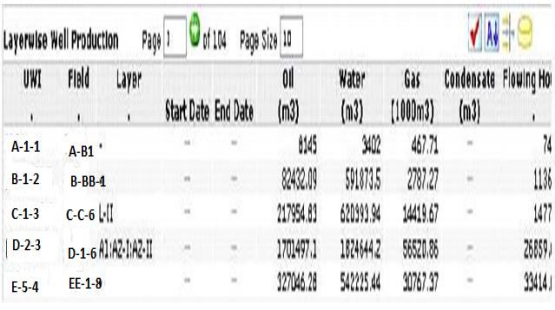


Fig.: 8 Well wise Production



Process defined as

- Activities that are performed.
- Facilities in which activities are performed.
- Materials that are used in performing activities.
- Properties that are measured during activities.

The pictorial representation of EPINET results are shown in Fig. 9.

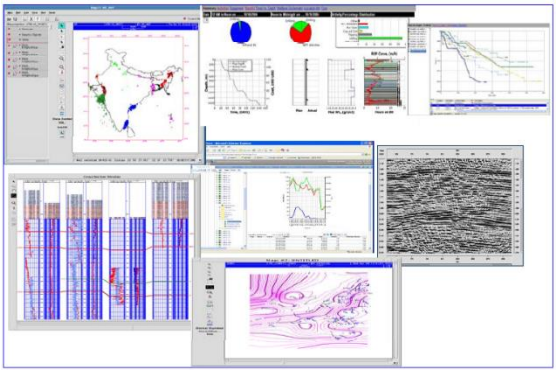


Fig.: 9 EPINET – Results at a glance

ONGC has gone for the state of art of technology i.e. up-gradation of Finder and other associated E&P Software to new family of products called **Prosource Product Suite** which is based on the Seabed open data model. The following are the main components of Prosource E&P Data Management Suite.

Prosource Enterprise

ProSource E&P Software – Professional Data Management Suite of products to streamline essential workflows of the Information Management professional and is powered by the Seabed open data model, which provides flexibility and supports new domains and applications. The Seabed system is open and accessible through SQL and interfaces such ArcSDE (Spatial Database Engine) from ESRI. The Prosource Enterprise single interface leverages the lessons learned from Finder and Geo-Frame software.

A common user interface complements and interacts with the other Prosource extensions. The combined Prosource environment and Seabed technology enable complete data storage, the integration of domains and comprehensive corporate information management through a single

desktop application for browsing, editing, creating, managing, and transferring data from many repositories.

Features

- Data transport history access
- Process deviation surveys
- Cartographic calculator.
- Data entitlements, transport, loading, and exporting
- Native ArcSDE (Spatial Database Engine) Server - Software Relational Database Management System.

Advantages

- Cross-references database queries by selecting data in one repository and using it as a constraint for accessing data in another.
- Enhances productivity by supporting secure information sharing with partners and contractors through row level data entitlements.

Prosource Seismic Data Management

Pro source Seismic manages all forms of seismic trace and supporting data through a single interface (map or tree-based fig.10). Interpretation project management for single or multi-vendor environments is supported by advanced tools to load, quality control, and transfer data between projects. Functions include a comprehensive system for managing field and processed data, complete with GIS tools and the open Seabed advanced E&P data store. The main features are seismic scan/edit/load, tools to load, quality control, and transfer data between projects. Functions include a comprehensive system for managing field and processed data, complete with GIS tools and the open Seabed advanced E&P data store. The main features are seismic scan/edit/load, navigation loader, SegY quality control and edit tools, Geo Frame and Seis Works project scan to create live trace displays and common Seabed database.

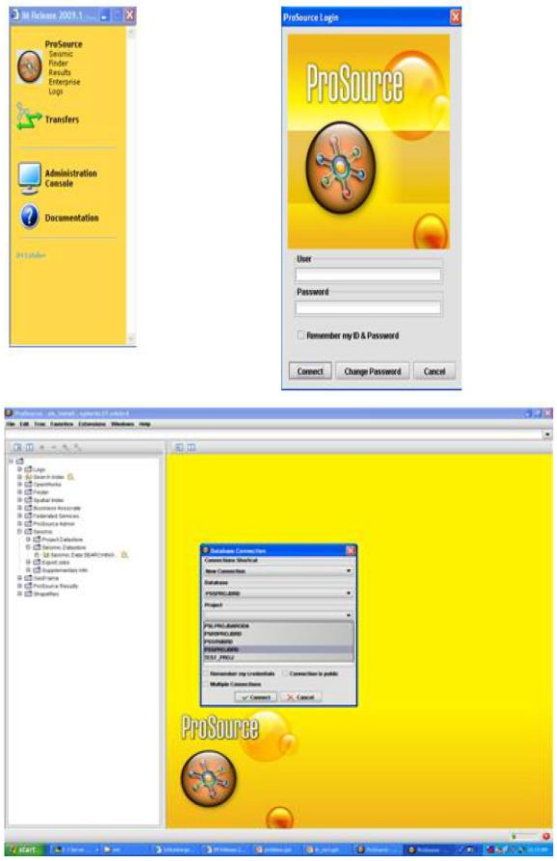


Fig.: 10 Prosource – Log in Page

Prosource migration and roll-out for seismic data. GIS view, 2D & 3D seismic data generated from prosource are shown in fig 11 & fig.12 respectively.

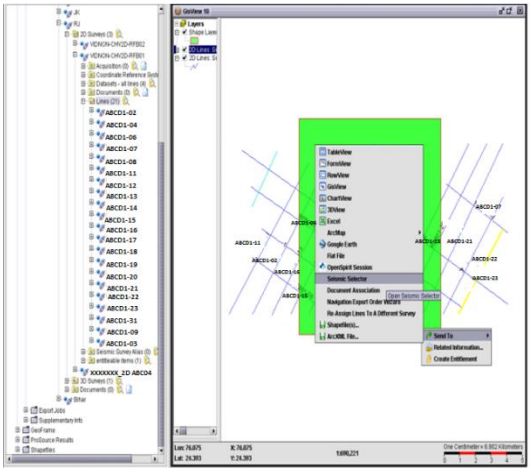


Fig.: 11 GIS View – Seismic

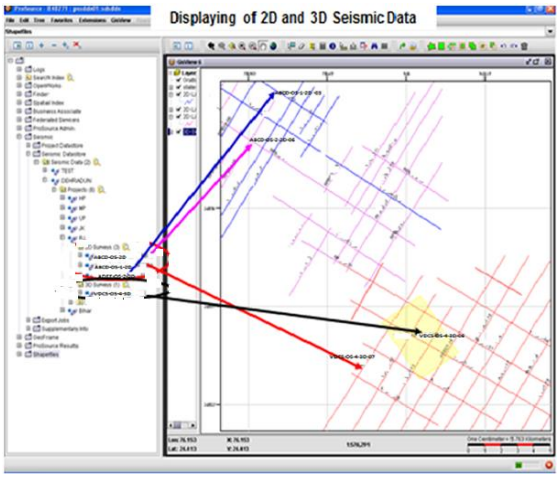


Fig.: 12 2D & 3D Seismic Data

Advantages

- Fast identification of available and overlapping data throughout automatic scans of interpretive projects.
- Quick intuitive access to all seismic data in multiple formats
- Simplified data clean-up, providing a more efficient, accurate input process through
- automated editing, QC, and loading tools
-

Prosource Log Data and Quality Management System

The Prosource Logs next-generation well logs information management solution is a high-quality data environment for well log data access, exchange, and storage. The user-friendly interface allows you to manage log data and makes collaboration and decision making easier. It is supported by advanced tools for loading and visualization, Pro source Logs streamlines integration of new well log information into your project environment. The main features are it manages high-value interpreted work station ready well log curve data, hierarchical data entitlements control access to well, well bore, log, or channel set level & enhanced reporting capabilities track and control database activity. A Prosource view of well Log data is shown in fig.13.

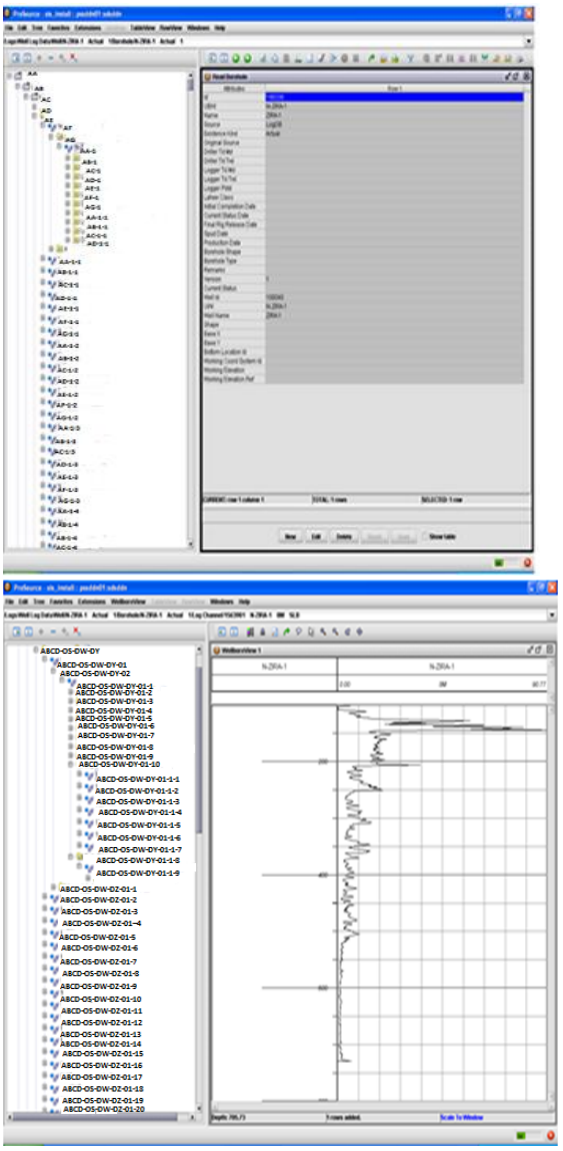


Fig.: 13 Prosource View - Well Log data

Advantages

- Single operation allows easy loading of well log data files and associated documents and images that can be viewed from the client application
- Map view of well locations enables easy selection of log files and curves from wells in a Geo-graphic area of interest.
- Two-stage loading process allows data Quality Control (QC) and validation in a staging area prior to populating the corporate data store.

Support Key work Flows for standard data types

- Digital Log Interchange Standard (DLIS), Log Information Standard (LIS), Log ASCII Standard (LAS)
- Original format scan, validate, load / original & edited export.

Future Trends

The present task of migrating Exploration & Production Information Network (EPINET) Finder database to new Prosource environment is a challenging endeavour. Prosource Seismic & Prosource Logs have been already migrated. Geo-frame package migrated to Linux server and the current data is being managed in new Prosource environment. The process of migration of well database is in progress to Prosource. The next step after migration of Finder database is to have all the modules under one roof in Prosouurce Enterprise Integration. In future it is also envisaged the storing of the Interpreted data in Prosource environment. The three tier based licensing mechanism is being optimized and thereby reducing AMC costs and optimising of license across Oil & Natural Gas Corporation (ONGC) enterprise.

Conclusions and Recommendations

In the present order of E&P world, storage and retrieval of information have become critical for business workflow, and access to the right information at the right time is a key to competitive edge. With the acquisition of ever-increasing volumes of G&G data, the result has been an explosion in the size of data that underlies the information, the industry needs for rapid, accurate decision making. The source of data & information retrieved from the system acts as a tool to the MIS for decision making by creating a real framework that ensures accurate and right data analysis, leading to timely and right decision making based on facts.

A considerable volume of geophysical data along with other E&P data have been migrated and implemented with state of art technology at all Assets, Basins and Forward bases including the Corporate centre at KDMIPE Dehradun, and other R&D institutes such as IRS, IDT and IOGPT. The final build and deploy activities are being carried out by the EPINET teams across the country. However, technology can only assist in data management and quality control and cannot solve the problems on its own. Technologies are no substitute to good housekeeping. Resources are available to a considerable extent and the teams are devoted at all work centres to perform basic tasks including verifying compliance of standards, cleaning up data, archival of correct data and interpretations. EPINET teams have realized that strict compliance of standards, definitions, codes, procedures etc. is essential to maximize the benefits of technology underlying the EPINET system. With geologists, geophysicists, petro-physicists and reservoir, drilling & production engineers, all looking at the same data models at the same time, immeasurable value to the company will be visible in the near future to obtain new exploration leads.

As growth in worldwide demand for oil and gas continues unabated, particularly in developing countries, the upstream E&P industry has launched major initiatives to optimize the search for and production of conventional hydrocarbons--a cradle-to-grave mindset that begins with field discovery and extends throughout its lifetime until abandonment. In today's highly price sensitive market situations, the focus has been two-fold: reduce the costs associated with finding, accessing and producing new reserves; and maximize recovery from existing reserves. The implementation and integration of EPINET resource management System, shows that ONGC is focusing, to a much greater extent, on a multi-dimensional, process-based approach that recognizes the advantages of merging a variety of technologies and disciplines, converging to value-added solutions that overcome problems. Data and information are tremendously valuable assets which, when used correctly, can provide the differentiation needed in a very competitive world. Those companies that embrace change and technology in today's information-centric world will be the winners of tomorrow by **"Getting right the first time, every time".**

Views expressed in this paper are that of the authors only and may not necessarily be that of ONGC.

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Abbreviations

1) DM – Data Management
2) DDRs - Daily Drilling Reports
3) EBCDIC - Extended Binary - Coded Decimal Interchange Code
4) EPINET - Exploration & Production Information Network
5) E&P – Exploration & Production
6) E&D – Exploration & Development
7) GIS – Geo-graphical Information Standard.
8) G&G - Geological & Geophysical
9) ICE - Information Consolidation for Efficiency
10) IDT - Institute of Drilling Technology
11) IOGPT - Institute of Oil & Gas Petroleum Technology
12) IRS - Institute of Reservoir Studies
13) KDMIPE - Keshava Deva Malviya Institute of Petroleum Exploration
14) LAN/WAN - Local Area Networking / Wide Area Networking.
15) ONGC – Oil and Natural Gas Corporation
16) POSC - Petro-technical Open Standard Consortium.
17) PPDM - Public Petroleum Data Model.
18) R&D – Research & Development
19) RDBMS - Relational Database Management Systems
20) SegY – Format for storing Seismic data.(www.seg.org)
21) SSL - Spread Sheet Loader
22) SQL - Structured Query Language
23) UOM - Unit of Measure
24) VSP - Vertical Seismic Profile.
25) XML - EXtensible Markup Language
26) 2D - Two Dimensional
27) 3D - Three Dimensional.

References

P.K.Mittal; C.L.Badoni and S. Bhattacharya, KDMIPE, ONGC, Dehradun, India "6th International Conference & Exposition on Petroleum Geophysics "Kolkata 2006".

Naresh Kumar, Sanjay Chakravorty, S. K. Mehta, Tariq Hussain, A. V. Rao, A. V. Satyanarayana & A. K. Tyagi. "Current E&P Data Management and Reporting in ONGC - A Step towards Right Time Data Availability & Future Consolidation.

P.K. Mittal, ONGC, and D. Chatterjee, Schlumberger; "EPINET in ONGC India: Transforming E&P Information into Energy Intelligence".

P.K. Mittal, KDM Institute of Petroleum Exploration, Oil & Natural Gas Corporation Ltd., Dehradun, India. "Setting up of Exploration & Production Information Network in Oil and Natural Gas Corporation".

S.F.H Rizvi; EPINET, KDMIPE Campus, Dehradun, "Training Programme for EPINET End Users under Programme Code: SP-05, 12th to 16th Dec 2011".

Links referred

1. http://www.energistics.org
2. www.oilit.com
3. www.ppdm.org
4. http://www.energistics.org/witsml-standard
5. http://www.slb.com/services/software.aspx