Geophysical Data Management Through EPINET Project

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Summary

Oil and Natural Gas Corporation (ONGC), an integrated National Oil company, has undertaken Exploration & Production Information Network (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. The 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, Gravity-magnetic as well as well log data is made available online to remote users. This paper summarizes ONGC's data management strategies and initiatives for harnessing the state-of-art technology, challenges faced, achievements, the lessons learned, benefits derived and future plans.

Historical perspectives

It was perceived that ONGC was facing a number of problems with the prevalent E&P decision-making processes, including inconsistent subsurface data handling, discontinuities among operational groups and incompatible information systems. The company's geoscientists and engineers were working in cross-functional teams, but they lacked a common "integration platform" to facilitate better collaboration. ONGC actually had several segmented E&P databases and applications developed in-house or purchased from software providers.

Seismic data is being acquired in ONGC for over four decades now. Beginning with seismograph outputs on paper with split- spread or end-on shooting pattern and single fold (non-CDP) data, ONGC moved along with the rapidly advancing technology world-wide. Analog seismic recording on magnetic tapes began in ONGC in mid-sixties with MS-15 A equipment. Subsequently, digital data acquisition began in early seventies with DFS III equipment. CDP data acquisition started in the year 1969 with 6-fold data mainly being acquired in Gujarat, Assam and Ganga valley in the onland areas only. With the industry moving to higher and higher foldage data acquisition, ONGC also moved to 12-fold, 24-fold, 48-fold and stayed on to acquire large volumes of 96 fold data in 2D onland by its seismic crews for some time before marching ahead for higher foldage with acquisition of SN 388 and other equipments of 1000+ foldage capacity.

Offshore data acquisition started in the year 1975, with M/V Anveshak acquiring 2D seismic data in Mumbai High. Huge volumes were acquired for the first time, with an air-gun being fired continuously every 10 secs to achieve a 25 m shot interval. Seen against the backdrop of 100m to 240 m shot interval with an average of 60-100 shots acquired every day by a land crew, this was literally an explosion in terms of volumes of seismic data to be managed. One ship working round the clock on a voyage of two-three weeks and making four to six acquisitions in a year, acquired more data than all the seismic land crews, varying between 30 to 40, in number. In order to map minor structural features better for finer delineation of subtle traps, ONGC ventured into 3D seismics in the year 1986. Along with the global trends, ONGC 3D seismic crews went on increasing in numbers, from 3 in 1986-87 to 10 in 1992-93, 20 in 1998-1999 and 22 in 2005. As a consequence, the data volumes kept on increasing and became more and more difficult to manage.

With the increasing business challenges, ONGC has defined very ambitious corporate goals, towards which it is striving. It is committed to raise enhanced oil recovery factor to an average of 40 percent from existing fields and to double reserve accretion by the year 2020. These are rather tough goals. In order to achieve strategic objectives ONGC has initiated Exploration & Production Information Network (EPINET) project 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.
- Improve and standardize new integrated work processes and methodologies to enable cross-functioning of multi-disciplinary teams.

The EPINET project includes management of a broad variety of technical E & P data types, accumulated over the years during different business processes of the company including General well data, Geological data including well completion reports, Stratigraphy data, Well log curves, Drilling & Production data, Cultural, Lease and concession data, Seismic 2D/3D navigation as well as processed SEG Y data, VSP data, Gravity-Magnetic data, Seismic interpretation data, any gridded data, original log curves, physical assets, and others.

As part of the initiative, ONGC has selected a suite of Schlumberger Geoquest's Data management applications as its new E&P data management platform. The two companies signed an agreement to provide ONGC's nationwide E&P business units with a broad range of Hardware, software, services and support.

Project Implementation

EPINET Project involves installation of hardware and software at all Assets/Basins, class room and on the job training of ONGC personnel and migration of entire legacy E&P data (including log and seismic archive) into EPINET servers at basins, assets and other work centres.

Today, EPINET systems are installed at twenty one sites, both at corporate site Dehradun as well as at other business centres across the country. ONGC's IT infrastructure including servers and client systems have been upgraded to accommodate a growing number of concurrent users and more demanding applications. Three uniquely different pilot testing projects were conducted at Dehradun, Mumbai and Baroda in order to test the new software, hardware and data models, and to define appropriate templates for data loading into new data models. The Geoquest team established connectivity between EPINET systems and several proprietary ONGC applications. The actual migration of bulk data is being handled by teams of ONGC. A massive data transcription mission was undertaken and a significant volume of data could be located, loaded, validated and made available on line for use.

ONGC has to manage over fifty terabytes of E&P data including information from over 750 2D surveys, 260 3D surveys, 10,000 wells and 75,000 log curves under EPINET project. Robotic libraries are being utilized for near line data storage and softwares for automatic data loading, viewing and management of multiple volume files pertaining to entire 2D as well as 3D seismic trace data through current state of art technology. The robotic technology allows automated, reliable and fast storage and retrieval of data. Since the seismic data volumes are very large they cannot be stored online on hard disks and storage on cartridges mounted on racks with multiple cartridge drives are resorted to IBM 3590 cartridges can store 10GB on each cartridge. As a part of the EPINET project, ONGC has acquired AIT-3 based robotic libraries, with each cartridge capable of recording up to 100 GB data (216 GB in compressed mode) and a capacity of 120 cartridges (expandable to 360 cartridges) and dual hot-swappable cartridge drives (expandable to minimum 6 drives) for accessing or writing the data. This implies a total capacity of 12 Terra Bytes (in native mode) of near-line storage of seismic data. The libraries with capacities varying between 6 TB to 12 TB are provided at Dehradun, Vadodara, Calcutta, Mumbai, Jorhat and Chennai so as to be close to the seismic processing centres besides being located at the Basin headquarters. Today, with a data transfer rate of 12 MB/Sec, it is possible to transfer a large 3D seismic volume of 2GB in less than 20 minutes. When EPINET project is fully operational, implying that all data is available on line, our company plans to retire all the legacy databases and their redundant software applications, and switch over to a single integrated on-line database and oracle based storage-retrieval system.

To ensure the highest possible data quality, the activity for every data class is undergoing a rigorous QC process beginning with data validation, followed by format conversion and loading by migrating into the relevant Oracle tables. Data management requires all geologists, geophysicists, petrophysicists and reservoir engineers to carefully review and select appropriate data for loading into respective servers. ONGC has also initiated updation of procedures for data transfer, as well as standardization of nomenclatures for all data types including well Ids, log curves, 2D & 3D seismic volumes, codes & symbols and stratigraphic layer names. It is a very challenging process to get experts of multiple disciplines actively involved and to reach an agreement on common standards and methodologies to be followed. The company sees tremendous value in such standardization. To make sure the 'valley of pain' is as narrow as possible," ONGC has

taken up massive EPINET awareness programme through News Letters, formal as well as informal meetings, conferences, trainings and workshops.

Management of seismic data

Most of the seismic navigation data have already been managed during the project. However, entire 2D as well as 3D seismic stack and migrated data is now being covered and is being managed by utilizing current state of art technology. ONGC has acquired robotic libraries for near line data storage and softwares for automatic data loading, viewing and management of multiple volume files. Seis DB and SAM-FS softwares of M/S Geoquest are being utilized for this purpose.

Robotic magnetic tape cartridge libraries are now being used in seismic industry worldwide for nearline storage of terabytes of seismic data. Therefore, ONGC has decided to acquire AIT-3 based robotic libraries , with each cartridge capable of recording up to 100 GB data (216 GB in compressed mode) and a capacity of 120 cartridges (expandable to 360 cartridges) and dual hot-swappable cartridge drives (expandable to minimum 6 drives) for accessing or writing the data. This implies a total capacity of 36 Terra Bytes (in native mode) of near-line storage of seismic data. The libraries with capacities varying between 6 TB to 18 TB are provided at Dehradun, Calcutta, Baroda, Mumbai, Jorhat and Chennai so as to be close to the seismic processing centres besides being located at the Basin headquarters. With a data transfer rate of 12 MB/Sec, it will be possible to transfer a large 3D seismic volume of 2GB in less than 5 minutes.

Seismic data loading:

We have adopted the policy of loading legacy SEG Y 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 Character consists 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 EBCIDIC Header for 2D as well as 3D data (Figs 1 and 2). Some of the parameters of EBCDIC header have been made mandatory for loading the data into EPINET System. Further all the processing centers 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. For 2D data, a separate software (epinetsgycpy2D) is used to edit the 2D header and put the header parameters in standardized format while for editing of the headers in 3D data, epinetsgycopy3D program is used. The edited and finalized Headers can be conveniently viewed through SeisDB (Fig 3).

Four different versions of processed seismic data being loaded in EPINET viz. DMO Stack, MIG Stack, PSTM and PSDM. In case there are multiple versions of reprocessed data, the finally accepted reprocessed version as approved by Basin/Block Manager incharge of the area is being loaded. The detailed work flow describing the steps involved from data collection to header editing and loading into SeisDB is shown in Fig. 4.

Current data management:

The current data flow for seismic data management is depicted in Fig 5. Data from processing centers (RCC/ SPIC/GEOPIC) is to reach EPINET Centre at Basin/ Corporate center within 7 days of completion of processing as one SIG/3D Volume through LAN or IBM-3590 cartridge. In case the data is received on tape/cartridge, the data is first copied into disk. The data after proper editing and validation is loaded in EPINET within seven days. IBM-3590 tapes are then being deposited to TMS/Tape Library of the concerned processing centre. The seismic navigation data is being received by EPINET Center directly through offices of respective Heads of Geophysical Services (HGS).

Management of Interpretation projects:

ONGC has also acquired seismic data interpretation softwares through which interpreters working at Interactive Interpretation Work Stations (IIWS) are able to manage their seismic data requirements with great ease. The stack and migrated data is stored in SEG Y format in robotic libraries ' Near Line'. SAMFS software of Schlumberger is utilized to retrieve the data. SAL (Seismic Auto Loader) and DTM (Data Transfer Module) are utilized to transfer the data through LAN to the IIWS. It automates

EBCDIC Header Format for 2D Data

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
--------------------------------------------------------------------------------
C 1 CLIENT: OIL AND NATURAL GAS CORPORATION LIMITED.   2D SEISMIC DATA
C 2 LINE: M125-02            SURVEY: xxxxxxxxxxxxxxx   AREA:xxxxxxxxxxxxxxxxx
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                    VESSEL/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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Fig.1. Standardized EBCDIC header for 2D seismic data

the flow of data from cartridges to IIWS or desk tops and then the interpreted data can be stored in FINDER for use by others in future. Multiple versions of interpretations can be saved. The 'smartdoc' feature within FINDER package being utilized in EPINET comes handy to store electronic documents, which can include time slices, selected final interpreted sections, contour maps or important textual extracts from the interpretation reports.

The software along with an Oracle database creates and provides user-friendly links between navigation data and the available 2D and 3D trace data using a GIS interface. The interpreter can access the data by selecting the desired seismic line. The earlier interpreted seismic projects can also be conveniently accessed and integrated into the current project. The interpreted projects on widely varying industry-standard formats commonly in use in ONGC, e.g. IESX,

EBCDIC Header Format for 3D Data

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
--------------------------------------------------------------------------------
C 1 CLIENT: OIL AND NATURAL GAS CORPORATION LTD.       3D SURVEY
C 2 AREA:BLOCK GK-3        SURVEY:3D04-GKOS-GK3        PROSPECT:GK-3
C 3 SPHEROID:WGS-84        PROJECTION:UTM-42           CM : 69      CP2: XX
C 4 FIRST LIVE             INLINE:     1               X-LINE:     1
C 5 LAST  LIVE             INLINE:  2000               X-LINE:  2000
C 6 PROSPECT CORNERS:
C 7 A:DDDMMSS.S NDDDMMSS.S E B:DDDMMSS.S NDDDMMSS.S E C:DDDMMSS.S NDDDMMSS.S E
C 8 D:DDDMMSS.S NDDDMMSS.S E E:DDDMMSS.S NDDDMMSS.S E F:DDDMMSS.S NDDDMMSS.S E
C 9 G:DDDMMSS.S NDDDMMSS.S E H:DDDMMSS.S NDDDMMSS.S E I:DDDMMSS.S NDDDMMSS.S E
C10 ACQUISITION PARAMETERS
C11 RECORDING YEAR: 2004   AGENCY:PGS GEOPHYSICAL   VESSEL:ORIENT EXPLORER
C12 SYSTEM:24 BIT SYNTRAC  REC FORMAT:SEG-D         LOW/HIGHCUT: 3/206/276 HZ
C13 SAMPLE INTERVAL: 2 MS  REC LENGTH: 6000 MS         REC START TIME:   0 MS
C14 NO OF CHANNELS:  480   FOLD:                       SOURCE:AIRGUN
C15 SHOT INTERVAl: 50 M    GROUP INTERVAL: 25 M        NEAR OFFSET: 100 M
C16 LAYOUT:END ON          BACK CHANNELS:              FORWARD CHANNELS:
C17 NO OF RCVR LINES:  4   RCVR LINE INTERVAL: 200 M
C18 NO OF SHOT LINES:  2   SHOT LINE INTERVAL: 100 M
C19 ENTER ADDITIONAL INFORMATION HERE
C20 PROCESSING PARAMETERS  AGENCY:PGS GEOPHYSICAL      BASIC/REPROCESS
C21 PROCESSING GRID:       AZIMUTH: 90.5 DEG           BIN SIZE: 12.5 x 25.0 M
C22 G1   X: 0000000.0      Y: 0000000.0      INLINE:      1       XLINE:     1
C23 G2   X: 0000000.0      Y: 0000000.0      INLINE:      1       XLINE:  2000
C24 G3   X: 0000000.0      Y: 0000000.0      INLINE:   2000       XLINE:     1
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 PROCESSING STEPS
C36 PROCESSED OUTPUT STORED IN THIS TAPE:DMOSTK/MISTK/PSTM/PSDM
C37 DOMAIN:TIME/DEPTH      REC LENGTH: 6000 MS        SAMPLE INTERVAL: 4 MS
C38 BLANK
C39 BLANK
C40 END EBCDIC

If three grid corners are given, the fourth one is automatically defined and
hence not given in the EBCDIC header.

All text fields are left justified and numeric values are right justified as
CM - Central Meridian
In case of two parallels CM and CP2 should be used
```

Fig.2. Standardized EBCDIC header for 3D seismic data

SEISWORKS and GEOFRAME can be easily located, accessed and loaded into the current project (Fig 6).

This provides the much required and sought after data management tool for the seismic interpreter.

Log data management

Under EPINET project ONGC is currently managing raw logs as well as spliced, edited and ready to use merged logs by utilizing Logdb and Finder master database

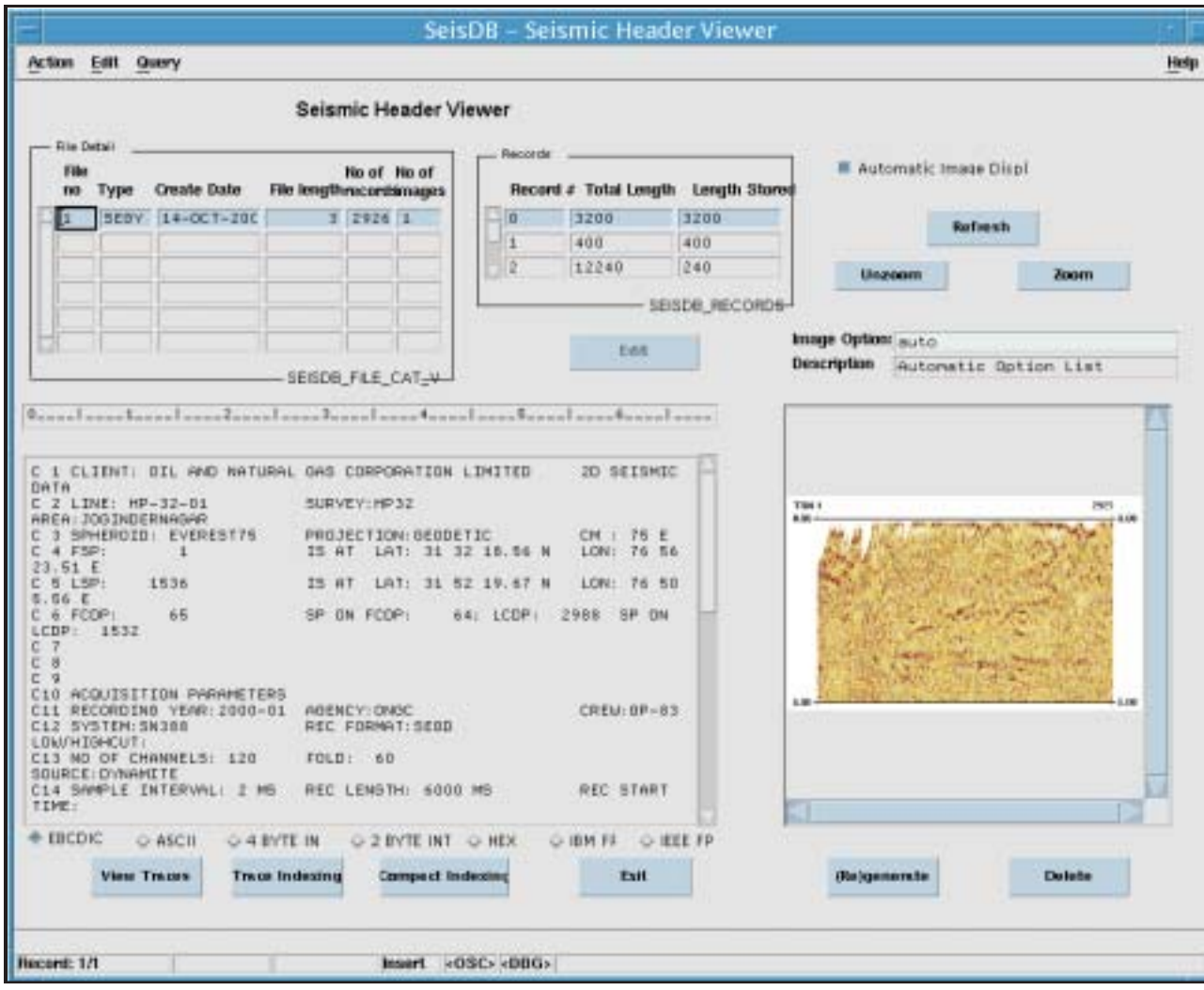

Fig. 3 Seismic header viewer in SeisDB

technologies of Geoquest respectively. Standard logs of over 6500 wells have already been managed for use by the geoscientists. ONGC has procured Geoquest's Geoframe Geology/ Petrophysics application for validation of log traces prior to their loading into Finder and generating merged logs. In this paper, technical details of log data management have been excluded.

Management of physical assets

Every E&P Company has non-electronic geophysical assets also, such as seismic films and paper sections, published and unpublished reports, lying in their warehouses. In order to obtain full value from the various types of data available, it is essential to include such data in the data management system. ONGC is utilizing Schlumberger's AssetDB software in its data management strategy for management of non-electronic assets. Thus unstructured information (in documents) becomes more integrated into E&P workflows and becomes available to end-users. To begin with ONGC is managing Physical asset data at corporate centre at Dehradun only. AssetDBweb software will enable users to browse availability of physical data along with their locations across the organization.

Web based data viewing

With the advent of web technologies, it is now possible to access various types of E&P data from the web. ONGC has also procured various web-based access tools

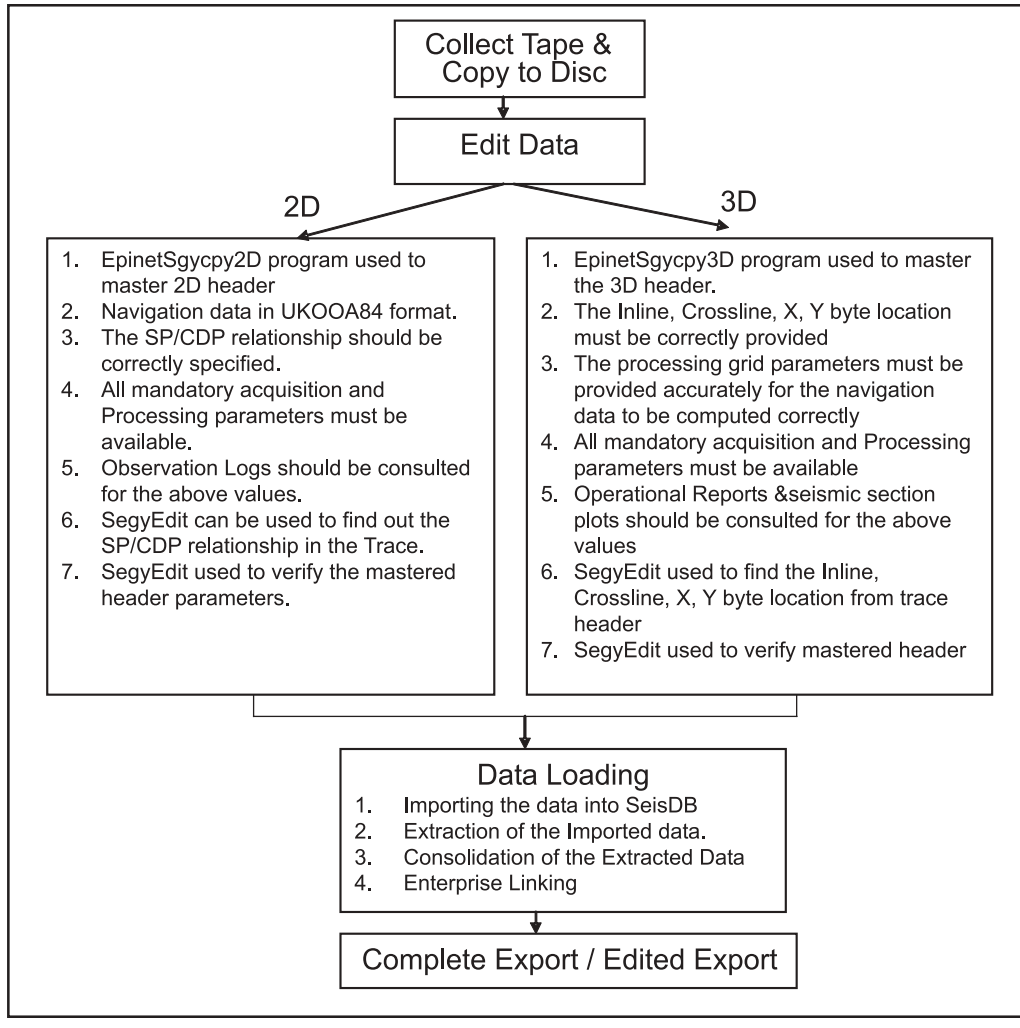

Fig. 4 Seismic Data loading workflow

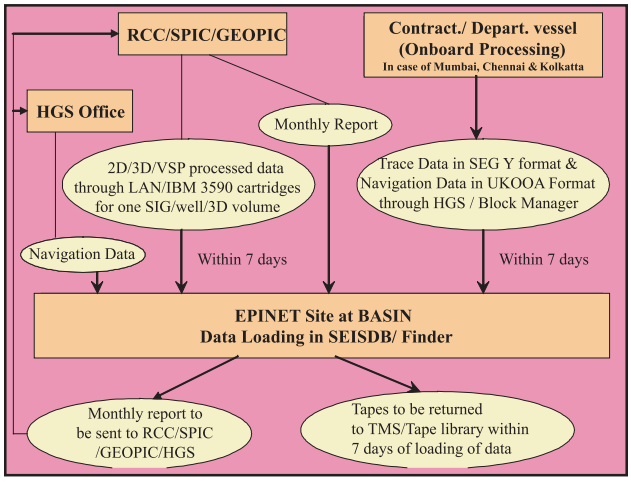

Fig. 5 Current seismic data flow

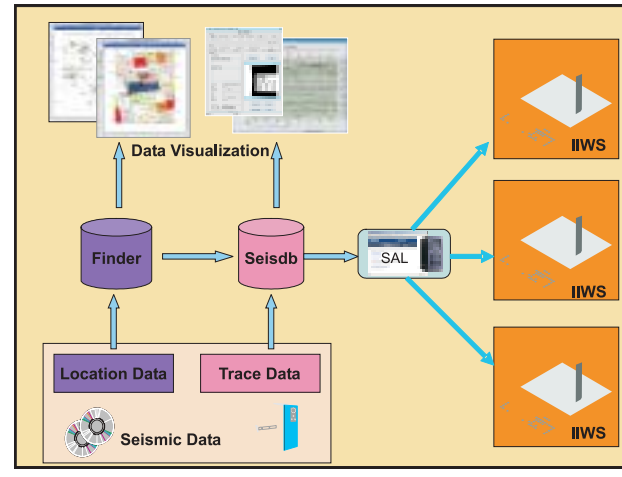

Fig 6: Seismic data flow to IIWS

which allow geoscientists to browse various data types e.g. Seismic, Gravity magnetic, Logs, well completions, Drilling, Production, etc stored in widely varying formats. Through a web-enabled interface, one can know which files are available on-line and which are stored near line on a high speed robotic tape/cartridge. The processing geophysicist can retrieve SEG Y stack/migrated data for post stack filtering, deconvolution, migration velocity analysis or other applications. The convenient access of multiple acquisitions of 3D data is very useful in merging a newly acquired 3D prospect data with earlier acquisitions so as to make a composite 3D volume. The interpreter can select one of the available versions of stack or migrated data in SEG Y format or an earlier interpreted version of data generated through GEOFRAME, SEISWORKS or other industry standard applications in ISX or other formats for his current prospect evaluation. Merged 3D data is also being stored and can be directly utilized by the interpreters.

Support for 3D Visualization

ONGC has already acquired two systems for 3D visualization, which are located at Panvel and Vasudhara Bhavan at Mumbai. More such centres are planned to cover GEOPIC, Dehradun as well as major producing Basins. These 'Third Eye' centres require voluminous 3D data from multiple disk volumes and tape cartridges, which are to be loaded into the work stations. Through the EPINET servers which have the required 3D as well as 2D data, it ias convenient to move the data through internal data network to the required work station. As mentioned in the preceding paragraphs, EPINET has the requisite softwares which can move data in SEGY, CHARISMA, SEISWORKS or other industry standard formats from multiple disk volumes or cartridges to the desk top or work station. GIS based capabilities enable the interpreter to see a map of the 2D and 3D lines and can select the lines of his choice.. The softwares provide a controlled and convenient environment for automatically moving large files between near line robotic libraries and on line disk storage.

Challenges Faced

ONGC now has over 50 Terra bytes of data including 2D as well as 3D seismic data. The processed data consisting of stack and migrated data generated from six different processing centres at Dehradun, Vadodara, Mumbai, Jorhat, Chennai and Kolkata are recorded in SEG Y formats, though the internal formats are different for the various centres since they have different processing softwares, ranging from softwares from PGS (Mumbai), Paradigm(Dehradun), CGG's GEOVECTEUR (Vadodara, Chennai and Jorhat) and PROMAX (Kolkata). Besides, a considerable volume is being generated by contractors through onboard processing. To complicate things further, the Interactive Interpretation Work Stations (IIWS) have their own softwares and write on various formats through applications like SEISWORKS, GEOFRAME, CHARISMA and others.

The seismic data is located at geographically distant locations, where the processing centres are located. Interpreters using IIWS at locations in various Assets and Basins all over India need the data for their use. However, the geophysicist would like to access various versions of data pertaining to his geographical area of interest without wasting much time on locating, reformatting or loading of the data.

In House Software Development

Some of the experiences and difficulties encountered by EPINET team during seismic data management are described here. Initially, the solution provider provided a set of commands for editing the EBCIDIC header. Subsequently, the commands were combined into a script and a utility was designed for the editing of EBCIDIC header in a more user-friendly manner. However, it was found that the script was unable to edit Binary and Trace Headers. So a need was felt to develop software for editing Binary and Trace Header. M/s Geoquest provided software SegyEdit for editing all the three headers. It was found that the utility was not user friendly enough for editing the headers as per the ONGC requirements which had been finalized by the seismic Task Force (Details described in the succeeding paragraphs) specially constituted to go into these aspects. In view of the inability shown by the solution provider to develop or provide such a software, in house efforts were initiated. Dr. JVSSN Murthy of ONGC, Chennai took up the challenge and developed a script with which all the three headers of 2D and 3D data can be edited in a user friendly way. The software is highly appreciated by the seismic users and all the seismic SEGY data is currently being edited using this software only.

An in house software has also been developed for logically connecting SeisDB database to PC environment through Java, which displays the number of stack and migrated surveys or their percentage in terms of total available data loaded in SeisDB so that we can find out the

data gaps in view of availability of different versions (STACK/MIG etc.) for the same survey. An in house program has also been developed for browsing all the fields/ parameters of data stored in SeisDb in PC environment.

As mentioned above, a Seismic Task Force was constituted to ensure smooth implementation in terms of data quality and user acceptance for Seismic Data Management. The Task Force performed the following functions:

I) Formulated the workflow and data loading procedures.

II) Ensured uniformity in standardization and nomenclature (e.g. seismic surveys, line numbers, header parameters).

III) Interacted with different processing centers to ensure smooth loading of Stack & Migrated data.

While aggregating the seismic data (SEG Y) arriving through WAN (peak rate 2 MBPS) from different work centres, we were facing a problem of differentiating between the surveys of different Regions. A new field 'Region' was introduced in SeisDB, which now helps us to quickly interrogate and obtain the surveys loaded in a particular 'Region' (Fig 7).

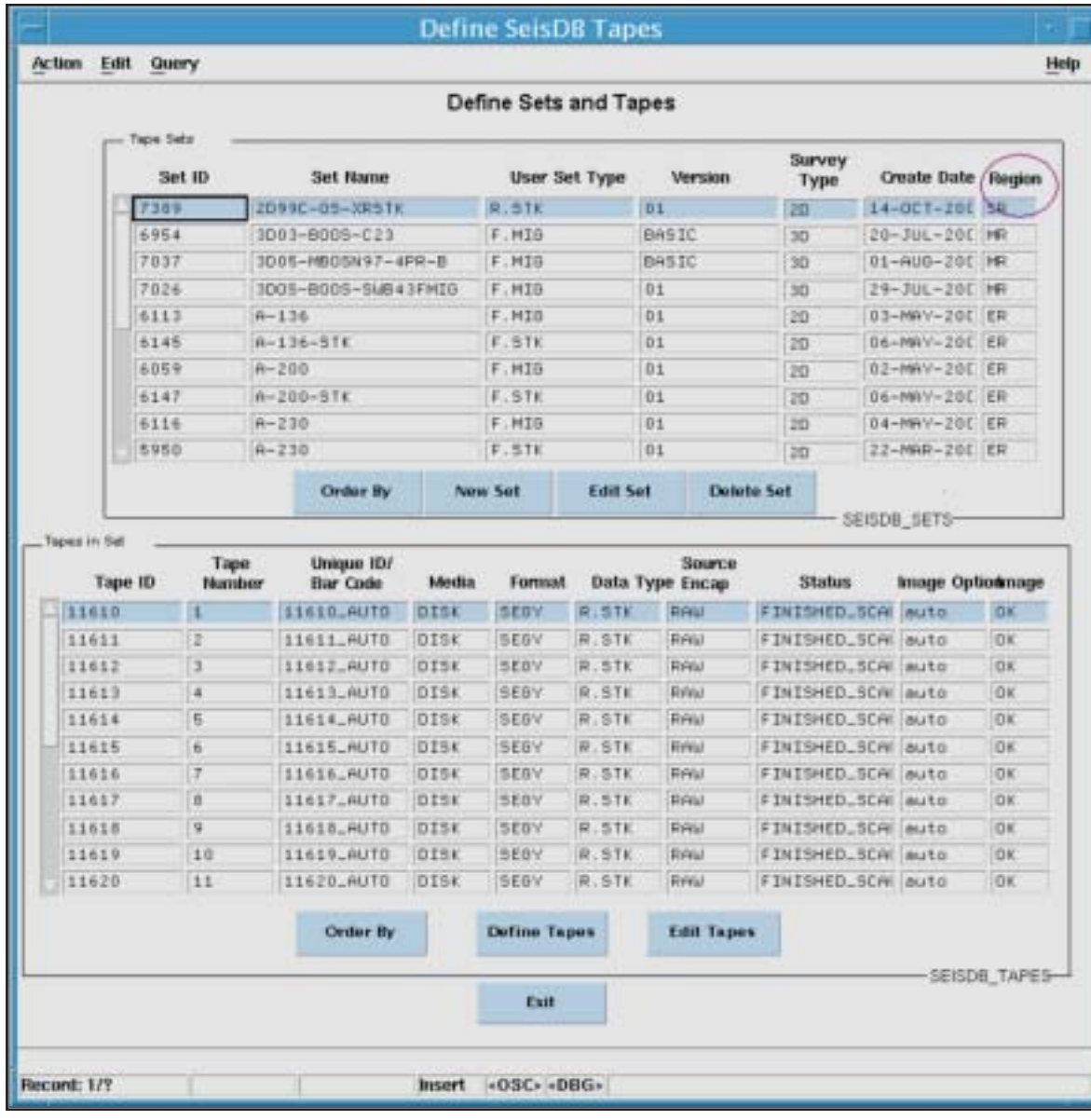

Fig 7 : Region wise data view during import to SeisDB

New work processes

The E&P work processes in our company are primarily designed to produce the technical information necessary to make business decisions. However, one can never underestimate the challenge of totally changing a company's database management systems. It requires an enormous amount of attention. After all, companies have got a business to run and the change management has to be carried out without affecting the core business of exploration and production. It's like changing the wheels while the engine is running. Changing culture and mindset is much more subtle and difficult to manage than changing technology. The most important issue is introducing new ways of working together. Integration has much higher value for the company as a whole than it does for any one professional.

To develop and optimize more efficient work flows using integrated applications and common project databases, ONGC has successfully created a "virtual" work-force of managers and technical experts from each of the E&P disciplines and sites. This could be achieved by implementing a plethora of IT facilities such as ONGC Intranet and EPINET Portal over LAN and WAN infrastructure with a good bandwidth. In addition to the management team of EPINET Data Managers, Discipline Expert Teams named as "Task Forces" were also formed for each of the disciplines: Geology, Seismic, Production Engineering, Reservoir Engineering, Drilling, Logging, Geolab and Software. Each discipline team had one expert from appropriate Basins, Assets or Institutes. The immediate objective of the teams was to iterate on the technical requirements for data capture, standardization, customization and data reports generation in their respective areas and come to a common model of data management.

Data is owned by the Assets, Basins and Forward Bases who generate the data and thus they also manage their data by themselves. EPINET project teams are only the custodians of data. An asset-focused distributed data management organization, though controlled centrally, is adopted by ONGC. New workflows and cross-discipline methodologies have been documented and made widely available via standard Web browsers on ONGC's intranet. It enables geoscientists and engineers to access improved workflows with detailed descriptions and illustrations, along with hints and tips for accessing and managing the data, standards and nomenclature, technical reports and professional articles.

Benefits derived

Benefits have started flowing in terms of increased availability of data. ONGC's corporate data store—based on the POSC data model and developed in conjunction with the Geoquest is being gradually operationalized. While seismic and other data loading is going on in full scale, ONGC users will be able to derive full benefit out of the project deliverables when the complete data is available by mid 2006. The geophysical community now have a suite of tools with GIS facilities to carry out map based browsing and execute out their queries to extract, import and transfer the required data through menu driven options with minimum training needs.

Because the EPINET project is aimed primarily at improving E&P decisions, its business value can be monitored and measured over a period of time. However, significant savings and improved efficiency are being realized. Trends have been observed in which most users utilize not only more data but also different data types than before, simply because they are so easily accessible. Some of the most active and important projects have already experienced benefits and productivity gains as a direct consequence of the EPINET project because of fast and convenient availability of seismic as well as well completion data

ONGC's premier R&D Institute - KDM Institute of Petroleum Exploration (KDMIPE), which is also nodal centre for EPINET, for example, uses a suite of integrated Geoquest/Landmark applications to successfully predict reservoir lithology and fluid content from seismic data in onshore as well as deepwater areas. Before any drilling decision is made, maximum possible data are used and enormous time is spent to get the right prospect description. Gradual operationalization of EPINET systems at various work centres is enhancing the quality of interpretation with significant reduction in the time spent by geoscientists in looking for, obtaining and reformatting the data for their Projects.

The company is improving the quality of its exploration programmes by migrating to a "shared earth model" environment. The geological model building and updation time is being reduced It is also believed that the newly imbibed technology and the new ways of working together will enable the company to find and produce more hydrocarbons at a lesser cost. EPINET has also enhanced the culture of collaboration within the project teams and

among other technological groups to the point when people start talking about 'our' work, instead of "my" work or "yours."

Conclusions

With the implementation of EPINET project 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 Institute of Reservoir Studies (IRS), Institute of Drilling Technology (IDT) and Institute of Oil & Gas Petroleum Technology (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 house keeping. ONGC's data managers are putting in their best to ensure that the domain experts respect standards. 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, petrophysicists and reservoir, drilling & production engineers, all looking at the same data models at the same time, immeasurable value to the company is sure to be visible in the near future.

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