Well Log Data Management (LogDB) – Its Role and Application in E&P Business.

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Summary

Well logging is the process of recording various petro-physical, properties of rock/formations penetrated by drilling. Log responses are functions of lithology, porosity, fluid–content and textural variation of formation. This information coupled with characteristics of sedimentary structures derived from high resolution dipmeter surveys provide detailed insight into the sedimentary environment and allows estimation of the reservoir geometry & orientations. As such logs are ideal tools not only for quantitative evaluation of fluid content of each potential reservoir but also for the estimation of the size, shape & orientation of the reservoir. Thus the overall objective of recording well logs is to hel find & recover more hydrocarbons, in an economic way.An efficient log data base is essential requirement for any E & P company.

To fulfil the objective, a LogDB software under EPINET Project, has been procured by ONGC Western Onshore, Basin, which is capable of handling and preserving all types of well log curves recorded in LIS, LAS & DLIS formats. At present standard logs of 3700 wells have been scanned, validated & loaded into LogDB at western onshore basin Baroda.

For the first time in ONGC, a Oracle log database has been created. In this the validated log curves in its original form, acquired by the various logging units at different onshore locations can be loaded and a detailed information of each curve can be made available on-line to all E&P users.

Introduction

Wireline logs recorded in conventional vertical wells, highly deviated wells Measurement While Drilling / Logging While Drilling (MWD/ LWD) and in horizontal wells Tough Logging Condition Services (TLCS) are the important part of drilling, well completion, geological mapping, well testing, work over, reservoir monitoring etc. The log data in the E&P database can help in planning future well logging operations as well as enabling efficient monitoring of existing reservoirs and any re-development programme.

Efficient storage and retrieval of information is a major task in any business, but it of utmost significance is the oil industry because of the large number of data classes and shear volume of data involved. To cope up with this ever increasing volume of information, companies are getting equipped with appropriate data management tools.

A wealth of new and upcoming computer technologies are presently available to directly address the information explosion and in this respect petrophysicists have not lagged behind. In early nineties from valve technology tools to today's third generation imaging tools with microchip processors, a great revolution in the history of wireline logs has occurred. With imaging system tools reservoir evaluation has improved thereby enhancing the oil and gas production.

Basic logging measurements contain large amount of information. With the introduction / advent of digital telemetry, there has been a manifold increase in the data rate that can be handled by the high-tech logging units. With the use of signals by radio, satellite, internet / telephone line, the data can be transmitted to different computing centres.

ONGC has drilled more than 10,500 wells during its 50 years existence in different basins which are spread across length and breadth of the Country. In order to make authenticated and validated data available to its Geoscientists and Engineers, ONGC launched a massive data management exercise under the project christened EPINET (Exploration & Production Information Network) Project. The project is aimed at making quality data available to its Geoscientists with in the shortest possible time at their Desk Top. Under this Project, one of the Database Servers has been installed at Baroda, where alongwith E&P Databases, the log database is also in operation since October / November 2000. The main log data archiving tool is called LogDB. With advancement of high-tech tools and the new generation imaging tools viz., (i) Array Induction, (ii) Dipole Shear Sonic Imager, (iii) Modular Formation Dynamic Tester, (iv) Ultra Sonic Imager, (v) Combinable Magnetic Resonance, (vi) Fullbore Formation Microimager and (vii) Combinable Seismic Imager and Array Seismic Imager which have been recently introduced in the market, voluminous amount of log data is expected / likely to be generated. With LogDB

already installed, it would not be a problem to properly manage such a huge data. All this data would henceforth be available to all E&P users throughout India via Local Area Network / Wide Area Network Systems.

The overall logging environment

Well logs furnish the data necessary for quantitative evaluation of hydrocarbons in-situ. Modern curves provide a wealth of information on both the rock and fluid properties of the formations penetrated. For decision making, logging is the most important part of the drilling and completion processes. Need for obtaining accurate and complete log data is thus imperative. Logging costs account only about 5% of completed well cost, which is negligible in view of the advantages offered by LogDB. Figure-1 illustrate the simple model of information resource filtering and header editing of each file before importing to LogDB.

Well log parameters – valued oinput in E&P application

It would be relevant to have a quick glance at the critical role, well log data plays in an E&P work flow (Figure-2 & 4). While the relative importance of well log data has been displayed, it is also relevant to understand the importance of parameters required to be stored in the Data Base and their work flow. An important area is reservoir

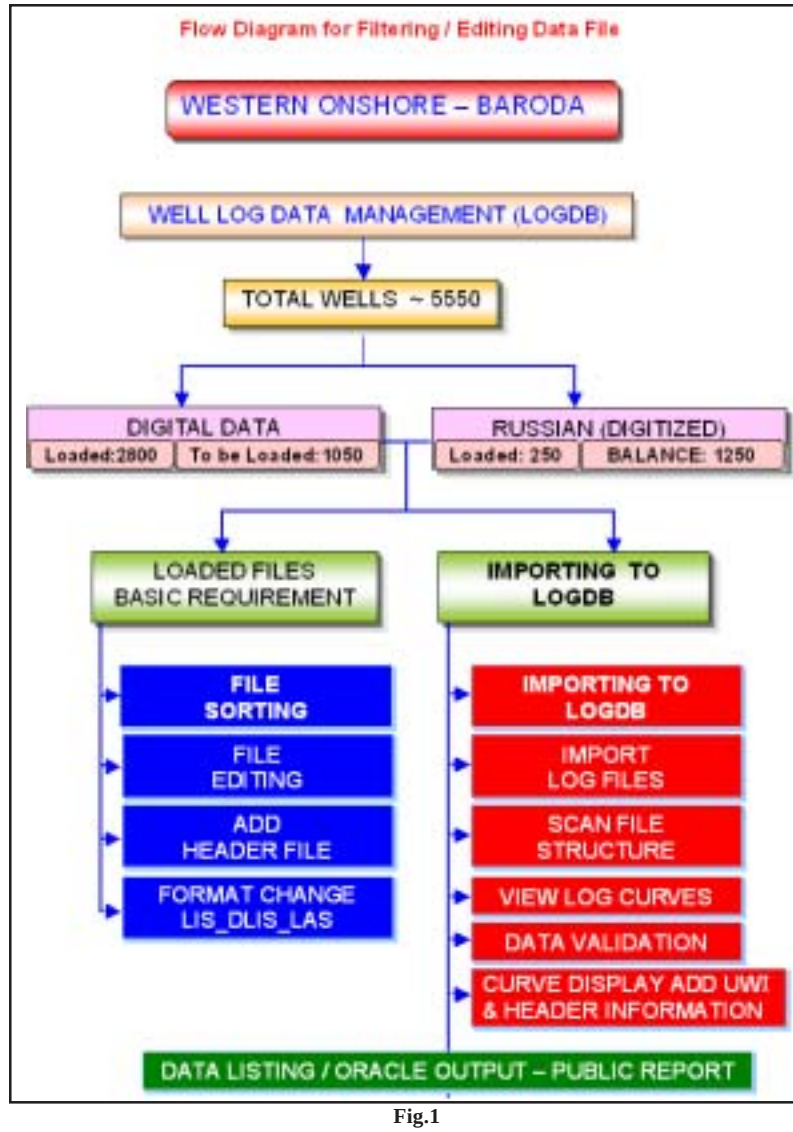

Fig.1

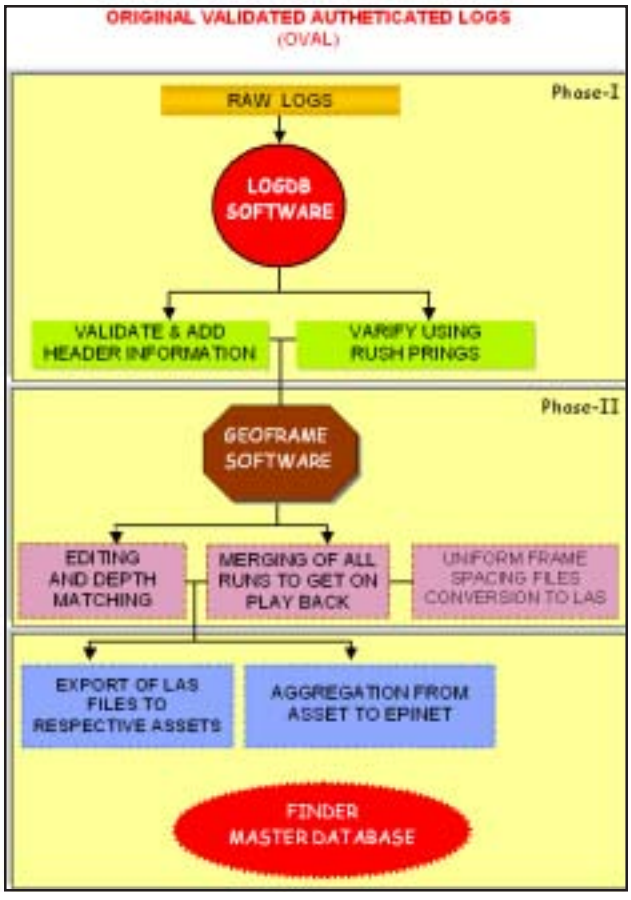

Fig.2

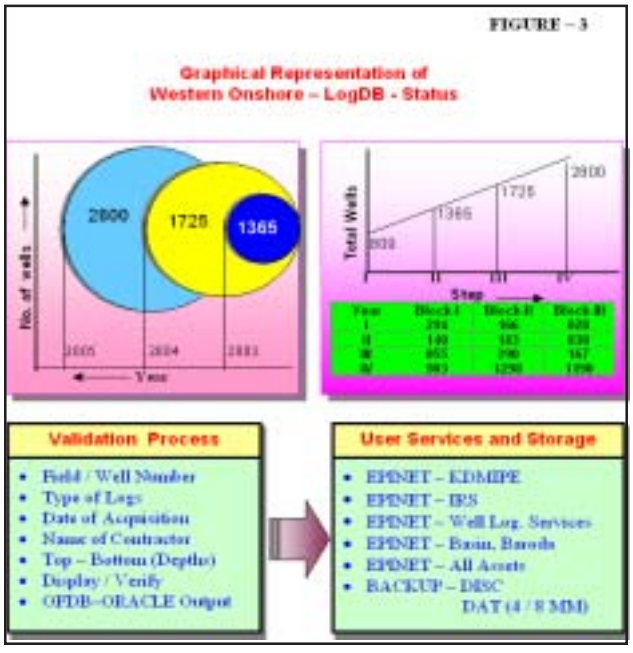

Fig. 3a

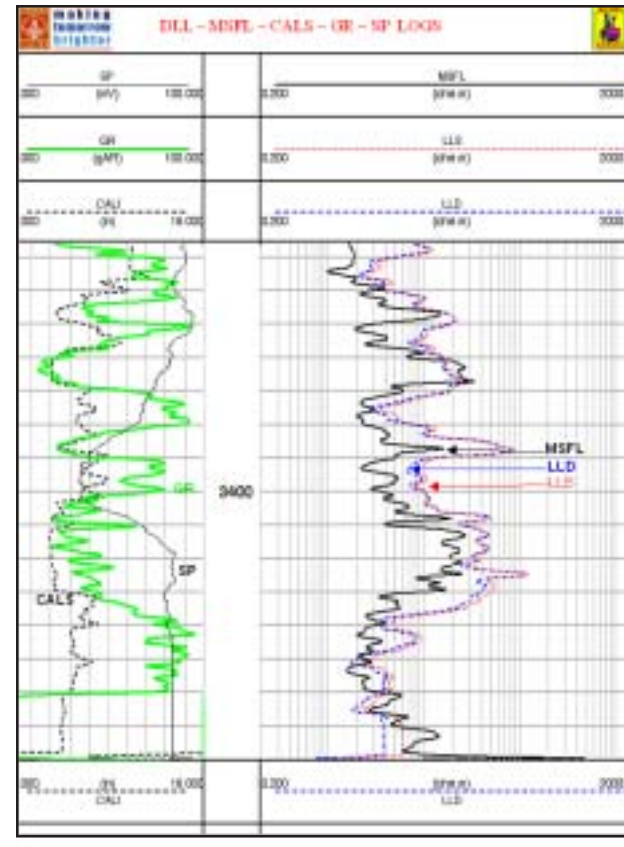

Fig. 3b

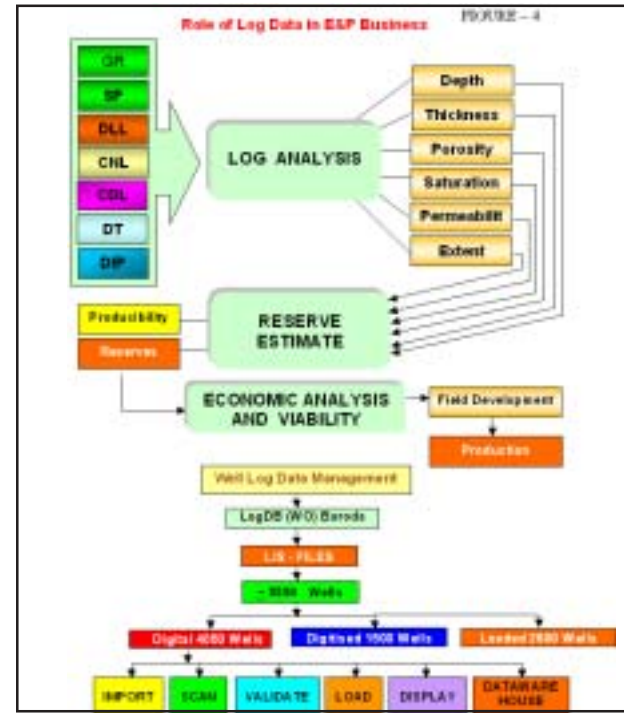

Fig. 4

evaluation d, which involves two parts. The first part, i.e. net pay, is quantified by porosity, hydrocarbon saturation, and thickness. The second is permeability. Both these rock quality descriptors are to be determined in any integrated study. This involves many steps before net pay and effective permeability are arrived. This shows the relative play of various rock parameters vis-à-vis log data analysis process, while determining rock quality. The integrated log analysis process would also involve other data viz., core and well testing data. Hence, for the multidisciplinary teams to determine the rock quality and the reserves thereon alongwith their producibility, a reliable and complete database becomes a prime necessity.

Status of legacy data in ONGC

Like any other oil company, ONGC Western onshore Basin including asset and Forward bases has also maintained well log data library of about 5,500 wells on different media during its evolution. As a result, the well log data exists in the form of tracing paper prints, optical films, 9 track tapes, Digital Audio Tapes (DAT) and Erasable Optical Disk (EOD). Figure-1 depicts an efficient work flow / procedure towards retrieving I extracting well log data from a Database Library. Figure -3 represent the log data loading ,year wise statistics of all the three Blocks at Baroda.

Migration of legacy data into LogDB

Western Onshore Asset / Basin Business Unit of ONGC is presently handling the log data of more than 5,500 wells. This includes a large number of old wells logged by Russian Units. The entire data is available on the hard disk of Well Logging Software Library. This log data is being migrated from LogDB and finally for editing and merging to get composite logs using Geofram utility into Finder DBMS Server (available at EPINET Phase-II Project), at concerned Assets. A procedure of data loading: (i) Import, (ii) Scan, (iii) Validate, (iv) Load, and (v) Graphic Display Figure-4 is followed to migrate this data.

The EPINET (DBM Project of ONGC) Server at Baroda is functional and log data of 2,800 wells has already been loaded into LogDB and is available to the users for different applications. The Log Data Management Tool viz., LogDB is very sensitive and any error allowed to remain in the database would get amplified in the calculation of porosity, water saturation and effective permeability. Error in the shaliness calculation will also cause additional error in porosity and saturation. Thus to obtain useful values of permeability, effective porosity and water saturation etc., lot of effort has been put in data validation before pushing the same to Master Data Base. With LogDB already operational and its integration with master database in Finder, Geoscientists have a perfect platform to perform any one or combination of the following applications:

(i) Well Area Correlation Mapping
(ii) Monitoring of Hydrocarbon Profiles
(iii) Resistivity Profile
(iv) Porosity and Permeability Contour of an Area.
(v) Oil Saturation and OWC/GOC/Variation
(vi) Sand Thickness Modeling
(vii) Field Extension
(viii) Seismic Data update using Wireline Logs
(ix) Reservoir Performance using Cased hole Logs
(x) Sick Well Analysis through PLT Jobs

LogDB ORACLE data output

In Western Onshore new initiative has been taken to list out the output of original formatted, recorded data available in the LogDB, using Oracle SQL Plus. This is to maintain the uniform industry standard, a SQL Software programme has been developed to obtain the desired output as listed below:

WELL_NAME	ACT_DATE	FILE_NAME	SERVICES	TOPD(MTS)	BOTD(MTS)	SEQUENCE
ABCB-006	29-JUL-1989	abcd6.001.h_17029	DIL-LL3-SP	1487.272	2223.668	ILISX1.020
ABCB-006	08-AUG-1989	abcd6.002.h_17030	DIL-LL3-DT-SP	1474.013	2457.450	ILISX1.023
ABCB-006	09-AUG-1989	abcd6.003.h_17031	CDL-CNS-GR-CALI	1790.220	2457.755	MES .004
ABCB-007	27-JUN-1990	abcd7.007.h_17034	CDL-CNS-GR-CALI	2273.808	2355.952	MES .001
ABCB-007	27-JUN-1990	abcd7.008.h_17035	CDL-CNS-GR-CALI	1638.757	2501.341	DSLT-B.004
ALPH-007	27-JUN-1990	alph7.001.h_17036	DT-GR	2201.733	2351.989	LDTD .005
ALPH-008	27-JUN-1990	alph8.002.h_17037	DT-GR	991.972	2502.408	LISCON.006
ALPH-008	09-AUG-1989	alph8.003.h_17038	DT-GR	1769.821	2499.970	LISCON.001
ALPH-008	09-AUG-1989	alph8.004.h_17039	DT-GR	1790.395	1921.612	DLTE .029
ALPH-008	09-AUG-1989	alph8.005.h_17040	CDL-CNS-GR-CALI	2308.708	2383.231	LISCON.003
BITA-008	30-DEC-2002	bita8.032.h_17041	CDL-CNS-GR-CALI	1812.950	2402.434	LISCON.004

Integration of interpreted data

ONGC like any other major oil and gas company, has been generating huge volume of well log interpreted data which is available essentially in the form of hard copies, known as formation evaluation reports. Naturally, this is not compatible with the available E&P data which is on Electronic Media. In order to over come this, log data, raw as well as interpreted under uniform electronic domain, a campaign has been launched where in already interpreted well log data on field(s) contributing to almost one third of Regions oil / gas production has been put on electronic media making it available for integration with the master database in Finder. A sample format of data is shown below:

Economy of LogDB – A profit centre

The basic concept of the logDB in EPINET Centre is to provide the finest quality product in minimum possible time. The final product is " Validated Well Logs". The prime application of the logDB is to provide on line log data transmission on the desk-top of an users and downloading selectively or accessibility through networking using LogDB_Web. The cost of loading log data is USD 6320=00 per well as Quated by an wireline logging company. But if the same log data is loaded by in-house resourses and manpower it will be much cheaper. For loading about 3000 well log data by single dedicated manpower, the ONGC is benefited by more than (Rs.60.48/) Rupees Sixty crore.Thus in all respect LogDB in this direction is definitely going to be Centre of E xecellence

Conclusions

The recently acquired Log Data Management Tool viz., LogDB, is a basic exploration and production supporting tool. The authenticated and validated data collection in a log database is critical for the fruitful application of this tool in any E&P study. LogDB, integrated tool with master database in FINDER, the user can have access using logdb_web to integrated Data Base. However, being recently inducted, a stupendous task is on hand to populate the Master Data Base with multiple data classes. The availability of data in a single database would save a huge drain on resources and cut-down time on the studies while improving the quality of the study immensely. Well log data of about 132 big and small & marginal oil field of Western Onshore with a total of 2,800 hole data, consisting of 1,16,479 curve with detailed output of each logs curve file are available in LogDB.

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Views expressed in this paper are that of the author (s) only and may not necessarily be of ONGC

References:

Schlumberger Oil Field Review, 1995

Ercill Hunt, SA Holditch & Associates Inc., College Station On Data Gathering – World Oil – 1996.

LogDB / Geoframe Manuals.

Field	Well Code	Well No.	Intervals (M) Top	Bottom	He (M)	RILD (Ohm.M)	VSH (%)	PHIE (%)	Sw (%)	Sxo (%)	HC (M)	Pma (gm/cc)	Remarks
XX	ABC	023	3026	3034	7.0	90.0	0.0	24.0	21	73	12	2.66	OIL&GAS
XX	ABC	024	3039	3041	1.5	5.0	26.0	18.0	76	95	0	2.65	SHALY
XX	ABC	025	2772	2776	2.5	2.5	30.0	19.0	86	97	0	2.65	BAD HOLE
XX	ABC	026	2972	2976	3.5	3.0	22.0	16.0	100	100	0	2.66	WATER