Streamlining Well Data Delivery

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Introduction

One of the major challenges associated with the capture and interpretation of data recorded while a Well is being drilled is the timely delivery of relevant data sets to the teams responsible for the decisions to be made around the development of the Well. The data delivery is complicated by the piecemeal nature of the acquisition process and the volumes and variety of the recorded data. A number of different data acquisition technologies may be employed for each section of the Well that is drilled, with MWD/LWD data acquired while drilling and openhole log data made available following one or more wireline logging passes. Preliminary data is often available as the Well is being drilled or logged, interim data is delivered once each acquisition phase has been completed and the final data sets are delivered once all acquisition on the Well has been concluded and the data has been edited and quality controlled by the acquisition company.

This paper describes a system that has been developed between Petris and Anadarko Petroleum Corporation to ensure that all relevant data generated while drilling a Well is captured, correctly identified and delivered in a timely manner to the asset team for interpretation.

Background

Anadarko Petroleum Corporation has been a user of the PetrisWINDS Recall Corporate Wellbore Database system for a number of years. Recall is used as a corporate database for Wellbore data, providing an online repository for high business value data (i.e. data that will be used on a day to day basis by the geotechnical community) in an Online Corporate Wellbore database as well as an Archive “Original Format” data store for all raw borehole data acquired by Anadarko. By 2003, the Corporate Wellbore database had a high profile in the Anadarko, and at the time contained around 40,000 Wells of borehole data.

Utilizing a team of three data technicians, Anadarko had spent a number of years loading and organizing borehole data in their Corporate Wellbore database. However, by early 2003 a number of problems had been identified relating to the process and data flows around the database. Anadarko Petroleum Corporation was drilling a large number of Wells, and the data load team was not managing to keep up with the influx of data. Each Well drilled generated a large number of different data sets. Each data set had to be correctly identified in terms of the source of the data, the type of measurement, the acquisition activity (e.g. main logging pass, repeat section, downlog etc.) and the expected data quality (preliminary, interim and final data delivery). Ideally, each data set should also be checked for completeness and the data visualized. Due to these delays, most data ended up being delivered in a variety of formats directly to the company’s asset teams, and it was feared that much of the data acquired by Anadarko was not being captured in the corporate database.

Anadarko drew up a list of aims with respect to the processing of Wellbore data delivered to the company:

- All data should be loaded into the Corporate Wellbore database as soon as possible
- Data should be made available to Anadarko's user community as soon as possible
- Data load into the Corporate Wellbore database should be as automatic as feasible
- A simple, unified data access mechanism should be implemented so that Users of Log data always get their data from the same place
- Users should be automatically notified following the arrival of their data into the system

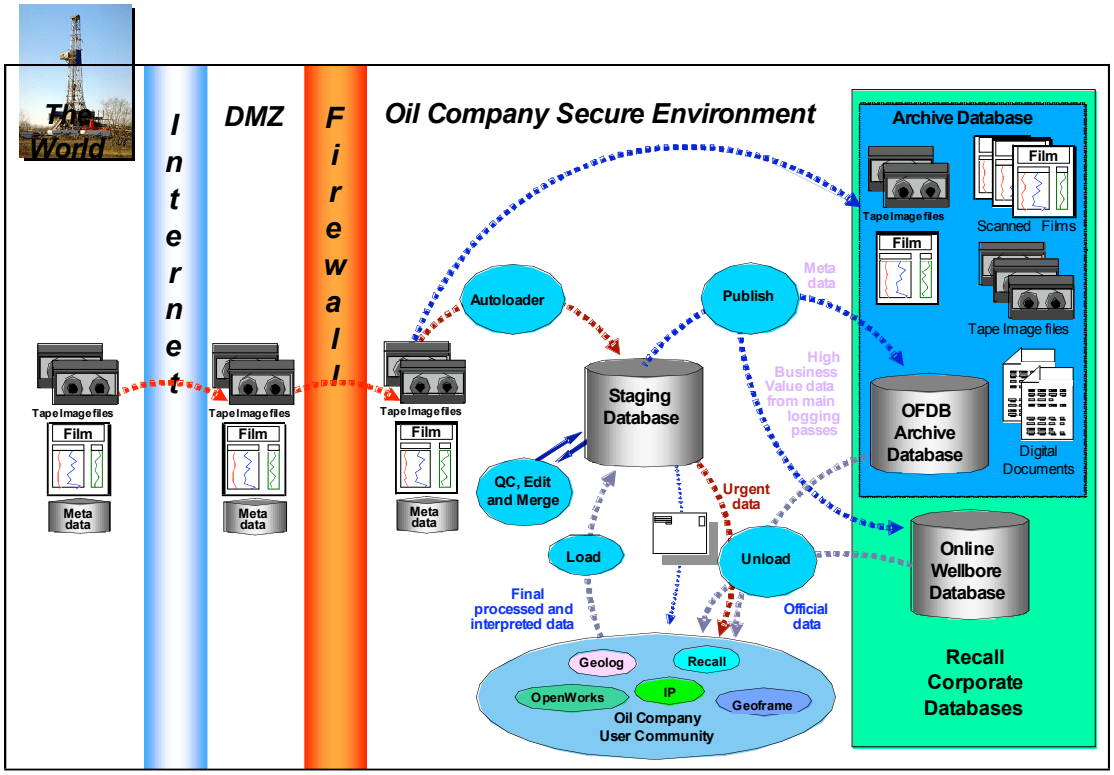
The following issues were seen to be important to Anadarko in the implementation of the system to fulfill the above aims:
- Data quality needed to be controlled
- Anadarko would like all data logged for the company by logging acquisition companies to be uploaded over the internet and automatically loaded into databases for subsequent User access
- Security should be implemented so that data from tight Wells should be available to a limited subset of Users.

The Recall development team worked with the Log Data management group at Anadarko to design and build a solution.

The streamlined Well data delivery solution

The solution developed to solve the Anadarko's Well data delivery problems can be broken down into a number of components:
- Initial setup
- Physical delivery of the data to Anadarko
- Automatic load of the delivered data into a Wellbore temporary or staging database
- Access to the loaded data by the user community
- Cleanup and quality control of the loaded data
- Publication of the quality controlled data into the Corporate Wellbore database

The solution, shown in the diagram below, was developed over several years, commencing with the implementation of an automatic data load mechanism, called the Recall Autoloader, to overcome the backlog of data to be loaded and to radically improve the speed and efficiency of the load process. The Autoloader has been used to load daily acquired data sets as well as some very large data sets that arrived as the result of acquisitions plus data sets purchased from commercial data vendors.



Streamlined Well Data Delivery

Initial setup

Before drilling commences on a new Well, the Well must be created in Anadarko's Well master database. The basic Well header information is then pushed to the Corporate Wellbore database. Users can then register interest in the Well, and this will ensure that the User will be notified when new data is added to the Well.

Physical delivery of logging data to Anadarko

Much data recorded by LWD/MWD and wireline logging acquisition companies is uploaded by the acquisition company over the internet into the acquisition company's web based data delivery system. Emails are sent out to the Oil Company client who ordered the work to be performed, and the client can then unload the data from the web site. This is an effective delivery method, but why not deliver the data directly to the Oil Company instead?

Once a logging job for Anadarko has been completed, the logging company engineer assembles the raw data that has been acquired and logs into the Anadarko web site. The logging engineer runs a query against Anadarko's Well master database and selects the Well on which the logging job has been performed. The engineer enters contact details such as their name, phone number and email address. Then, for each data set that has been acquired, the engineer selects the data file (usually in DLIS format) that has been acquired, selects the type of acquisition (e.g. Mud Log, Wireline Image, Wireline Digital etc) and uploads the data files over the internet into Anadarko's "demilitarized zone". The incoming files are checked, the meta data about the Well name and logging details written to a meta data "tag" file, and the data and tag files are then moved inside Anadarko's firewall for processing.

Automatic data load

At the heart of this solution is the Autoloader. The Autoloader is a highly configurable, rules driven mechanism that will load data into the Corporate Wellbore database.

The Autoloader process watches a set of source file directories for incoming data files. These files may be delivered over the internet, as described above, or may be dropped into any of the source file directories by Anadarko staff. Once a file has been loaded into a source file directory, the Autoloader fires up, identifies the format of the incoming file, decodes the meta data tag file and runs the appropriate data loader for the file. The target for the data load operation will depend upon the rules implemented for the particular data source. As an example, raw wireline data from Anadarko operated Wells will be loaded into a temporary database, often called a "staging" database, as the data has not been quality controlled. Data from commercial data vendors that has been quality controlled according to the Anadarko's stringent specifications will be loaded directly into the Corporate Wellbore database.

When raw Well data is loaded into the staging database by the Autoloader, it is flagged as unchecked data, and an email is sent to all Users who have registered interest in the Well. The data is organized by logging service, data quality, data source and acquisition activity so that the User can easily identify the different data sets. The User can then access the data in the staging database and transfer all required data into the relevant interpretation system.

Data loaded into the staging database must be quality controlled before being published into the Corporate Wellbore database. This task is performed by the same team that used to spend all of their time loading data. Data is validated for its completeness (has all expected data been uploaded by the acquisition company?), the expected header information, adherence to standard naming conventions, identification of all high business value data sets and the values of the measurements. In addition, the high business value data from the different logging runs are merged and spliced together to provide a contiguous data set for G&G applications such as the generation of cross section plots etc. All validated data is tagged with a quality control flag, and the data is now ready to be published to the Corporate Wellbore database.

Data publication to the Corporate database

Data is published to the Corporate Wellbore database once the quality control process has been successfully completed. The publication operation is a multi stage process:

- Various checks are made to verify that naming conventions have been adhered to and that mandatory header information has been populated
- The data files are transferred into the Original Format Archive
- The meta data scanned from the data files is written to the Original Format (OFDB) Archive database
- The high business value data sets are loaded into the Online Corporate Wellbore database

The high business value data published into the Online Corporate Wellbore database is the main reference data used by Anadarko geoscientists on a day to day basis. The acquisition data sets catalogued in the Original Format Archive database will only need to be made available to by expert Users who may need to refer to subsidiary or specialist data sets, repeat sections etc.

The situation today

The implementation of automated systems around the Corporate Wellbore database has been a huge success.

- The web based upload of acquisition data followed by the automatic loading of the data to the staging database has resulted in data being made available for interpretation within *fifteen minutes* of the completion of the logging job. Before implementation of this solution, a good data delivery time would have been a few hours, with typical data deliveries being a number of days – and then the data would have to be loaded manually.

- The team of data loaders has been redeployed to perform improved quality control on the database, as well as providing additional processing of high business value data.
- Anadarko has an official process to ensure that all borehole data acquired by the company is captured and loaded into the company's Corporate Borehole database
- Several huge data sets that were obtained as a result of the acquisition of other oil companies were loaded through the Autoloader, with only minor adjustments required.
- The database now registers nearly one million scanned raster films
- The Corporate Wellbore database has grown from around 40,000 Wells to over 300,000 Wells loaded automatically over the last three years. The database size is over three terabytes.
- All of the Anadarko's borehole data is available to the user community. The data sets are registered under a stringent set of naming conventions, allowing data to be easily searched, located and exported from the system.