

Drilling a well is a costly process, with a high element of risk that requires strict monitoring. Controlling cost and minimizing risk is possible only with reliable, unbiased, and real-time information. A number of drilling process control systems developed in the 1990's in the Russia Federation specifically used a set of sensors, a computer for data collection and a driller's console, or information panel. The implementation of a communications infrastructure, computing techniques, hardware and network solutions have enabled companies to monitor construction of facilities in real-time – not only at the local levels of process control hierarchy, but also at the oil company level. Thus information, scientific and technical resources of different departments, and the whole enterprise can be engaged in decision making with relative ease.

With the advent of the digital oilfield, one of the main elements of the Russian Oil and Gas Field Lifecycle Interactive Management System (Unofactor) is Wellook technology – based on the use of the most actual international standards, which includes Energistics' WITSML open data exchange standards. Energistics serves as the facilitator, custodian and advocate for the development and adoption of technical open data exchange standards in the upstream industry.

WITSML stands for the Wellsite Information Transfer Standard Markup Language which employs XML technology to create business value through efficient standardized exchange protocols. Many integrated, independent and national oil companies have adopted the WITSML standard for real-time well data communications, or are planning to use it in the near future. The number of WITSML-compatible products is growing rapidly and the standard is currently embedded in more than 40 software products globally. WITSML compatibility is becoming a standard contract requirement; in particular for high cost, high risk or high density drilling operations. WITSML promotes vendor software interoperability and is becoming a common technology in drilling data collection.

Wellook is a Russian online well operations monitoring and information support system for well construction. Taking into consideration the massive volumes of data and the continuous receipt and interpretation by Wellook, the developers decided to move from the widespread use in Russia LAS format as it describes only linear (planar) data structures and thus is not applicable for complex hierarchic structures. It is also worth mentioning that each vendor using the LAS format implements their own storing standards, incompatible with other databases.

One of the main features of the Wellook technology is the use of WITS and WITSML open international standards for data communication. This makes it possible to integrate to one technology chain for all national and international mud logging units, MWD/LWD systems, well cementing units, drill control systems and well geophysical survey systems with modeling and in-depth analysis software systems of international vendors. Wellook converters of real-time data were developed and implemented on mud logging units of different leading providers, working in the territory of the former USSR. Both incoming and outgoing data are communicated in the WITSML format.

A universal database (archive) in a WITSML-server and access to the server using the WITSML-protocol, allows integration of the Wellook data with any software for statistical or analytical data processing and visualization supporting the WITSML-standard. With a set of such converters, the WITSML-server is a link between the lower level software, presently providing incongruent data formats and the higher

level software of large vendors (Landmark/Halliburton, Schlumberger, Paradigm, Roxar), as it is mandatory for the latter to have all means of interfacing and data acquisition from WITSML-servers. Additionally, all mud logging units are able to communicate data in the WITSML standard. Moreover, well log data, LWD/MWD, cementing units data and others can also be represented in the WITSML standard which makes them transferrable to the WITSML-server. In this way, the technology integrates the data to the entire information system, from multiple drill sites and different acquisition systems.

Presently, Wellook is used not only in the SNGS geological and technological monitoring centers, but also in different Gazprom companies to monitor the data occurring from the mud-logging units from five different Russian producers, four of which do not provide data in the WITSML standard (in this case the SNGS converters are used). Wellook is also used and implemented (partially or full sized) in all SNGS clients (largest Russian oil and gas producers). The Wellook technology that provides data to a client's office regardless of software used at the drill site was developed in light of specific features of the Russian market of geological and technological services. The Wellook software is directly connected to the mud logging system securing a constant data entry; as the mud logging units, unlike the MWD/LWD and other systems, constantly functioning during drilling or finishing wells.

If the operator has not made a significant software investment, it is easy to offer simple access to the WITSML-server data. It can be done through thin client software via an Internet browser, as many international companies do, i.e. Geolog (Italy) in its software Wellcoms or Russian SNGS in the Wellook software (fig.1).

Wellook works with the Microsoft Silverlight technology – a software platform that includes browser plugins to run the applications with animation, vector graphics and audio/video files. Silverlight is realized for OC Windows (all versions), Mac OS X from 10.4 и browsers Internet Explorer (from 6.0 version), Opera 9.5, Mozilla Firefox (from 1.5 version), Safari 3.1, and Google Chrome 3.0. It is also possible to use Wellook on mobile phones and monitor the drill site right from the phone.

Unfortunately the WITSML standard has not yet gained adequate adoption in Russia, leaving Wellook technology as the only successful monitoring system. The reasons lie either with the lack of available WITSML servers or the inability to adopt at the corporate level. Software implementation has been found to be to be unprofitable for mud logging station producers, whereas strong IT companies have not yet cultivated this market (due to a number of reasons, one of which is tying between client's WITSML-applications on the drill-rigs with mud logging stations of different manufacturers, whose programming interfaces are private and are known only to their manufacturers).

Initially it was assumed that potential customers would be primarily interested in the possibility of using the WITSML server as a link between lower level software at the present time providing incongruent data, and the higher level software of a large vendor (Landmark/Halliburton, Schlumberger, Roxar and others), as it is mandatory for the latter to have all means of interfacing and data acquisition from WITSML. To explore these opportunities as part of the cooperation with Gazprom expert integration tests, the SNGS WITSML server was tested with Landmark/Halliburton and Roxar software packages.

A continuous real-time data import from the SNGS WITSML server to the OpenWorks database was performed with the OpenWire software; which can interface with WITSML servers as a client, and at the same time as an OpenWorks database client. In other words, the OpenWire software is the main liaison of the Landmark technology for real-time and near real-time data communication. Next, sharing the OpenWire and 3D Drill View software (3D geophysical modeling programs including real-time drilling and production data) the user receives a tool for a detailed measure while drilling, and logging while drilling data (MWD/LWD) on an ongoing basis.

Facing this situation a few years ago the SNGS specialists began creation of the WITSML-based Wellook program. By now the WITSML server of the "SNGS" has implemented such objects as 'well', 'wellbore', 'log', 'mudlog', 'realtime', 'trajectory', 'opsreport' and 'message' in the 1.3.1 version, with more being developed. WITSML format convertors of real-time data coming from the units of different manufacturers have been developed so that the "SNGS" manufactured mud-logging units 'SNGS-300' are channeled to direct interaction with the WITSML server without converters. It should be taken into consideration that all foreign mud logging units are able to communicate data in the WITSML standard, as well as well log data, MWD and cementing operations units data.

In Roxar's RMS 2009 software the WITSML standard supports additional uploading of drilling information such as logging, inclination and drilling parameters from the server. RMS wellstrat (interwell correlation module) and RMS WITSML (well drilling monitoring and geological process modeling according to borehole information) are good examples. The WITSML standard implementation allows users to visualize and interpret 'live' data, i.e. the data generated during drilling. A reservoir model can be updated by using the latest data and used for drilling optimization in real-time. As part of the integration process conducted within Gazprom companies, the RMS 2009 software package was connected to the SNGS WITSML server to obtain the real-time borehole path and logging ('WITSML real-time monitoring' option) with data visualization (i.e. on tablet computers) and in 3D.

Any of the widely spread database management systems, like MS SQL (including MS SQL Express), Oracle9.x, 10.x, MySQL and others can be used as data warehousing systems. This wholistic approach makes it possible to involve the complex of process, visualization and analytical software packages from different manufacturers supporting the WITSML format and creates an information environment for integral comprehension of the state of work; creating efficiency, forecasting drilling trends and enabling proactive managerial decisions.

Since 2010 SNGS and Energistics have been reciprocal members. This membership gives the Russian entity an opportunity to participate in international development of data exchange standards and receive additional information for further implementation.

In conclusion, this technology is the main part of the Unofactor, the Oil and Gas Field Lifecycle Interactive Management System adopted in Russia. From the beginning the development of this system was based on high-performance computing and international standards on data communication such as WITSML.

Side Bar

GEOS (a national geo-information system) is a comprehensive, integral system of software used for data acquisition and communication for the development and mass production of different field detectors, transmitter-receiver components, powerful computer systems, data channels and software products. Although it allowed saving obtained data, the system was mainly useful as an on-site parameter control. A computer analyzed the data coming from the sensors and alerted the drilling team when there were unusual indications. Additionally, the operator could print out a report of the collected data. An integrated system concept for oilfield development monitoring was developed in the USSR not long before its collapse, using GEOS. Within the GEOS project the integrated system of receiving, accumulation, communication and interpretation data on Earth conditions and structure with the use of space, aero, surface and subsurface monitoring setup was already being implemented.

Many concepts and technologies had to be newly developed following the collapse of the USSR. Among other things, fast transmission of data from the drilling site to the office is crucial for controlling the process. This data is transmitted to the regional levels of process control through landlines, cellular phones or satellite communications. Being hundreds of kilometers away from the drilling site, the experts had an opportunity to review the drilling data which had been collected a few hours prior. Although this task was incommensurate to the scales of the GEOS project, it was successful.

Moreover, unique technologies based on the GEOS project developments have not arrived on the international market until now. For many years the Russian Association of the Russian Oil and Gas Field Services Companies (Soyuzneftegazservice, SNGS, a non-profit organization, has been actively cooperating with the developers of this project which has resulted in a number of interesting and promising projects at the CIS level. It is with great regret that in the pursuit of political ambitions, some countries have succeeded in putting the Fulton's Iron Curtain on the way of information technology development. However, it has always been obvious that the implementation of the GEOS project on the continental shelf of the USSR could have sped up a practical realization of different oil and gas field lifecycle interactive management systems using high performance computing technologies (the follow-on "Smart fields", "Integrated operations" and other concepts).

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