SPE 112016

WITSML Changing the Face of Real-Time

N. R. Deeks, Schlumberger and T. Halland, StatoilHydro.

This paper was prepared for presentation at the 2008 SPE Intelligent Energy Conference and Exhibition held in Amsterdam, The Netherlands, 25–27 February 2008.

Abstract

WITSML is a key enabler in an increasing number of real-time workflows. This is particularly true for integrated operations within the growing numbers of onshore operations centers. Two years ago WITSML was a technology known by few and actively used by even less. Now the SIG steering the standard has grown to 51 companies.

The starting point for most companies in using WITSML is to bring depth data into their asset databases. For many this has become the norm. Early adopters like Statoil are broadening their use into a wider range of wellsite operations. Within asset teams a standard data delivery mechanism allows integration of new tools and workflows, letting Geologists and Engineers make use of real-time data within their familiar desktop applications. It also enables centrally managed data delivery services letting them focus on their areas of expertise, not data gathering.

New technology and processes in these areas are helping operators make the next big step from real-time remote monitoring to real-time remote control.

For growing numbers it is now not enough to receive a visual representation of the data. They expect data to be delivered in real-time via a standard format.

WITSML also brings operators the opportunity to standardize data delivery workflows, to clarify contractual requirements to providers and to establish and measure realistic data delivery KPIs.

Within Schlumberger WITSML enabled workflows are well established, answer products for drilling optimization and interpretation utilize the standard via a unified WITSML client. This reduces software development cycle time and simplifies data gathering.

WITSML is becoming established, bringing proven advantages to real-time workflows. Continued uptake of the standard will enhance the competitive advantage of service companies and the operators utilizing it. WITSML is here to stay and should be supported more widely within the industry.

Introduction

The Wellsite Information Transfer Standard Markup Language (WITSML) is a data transfer standard designed to facilitate the efficient and effective flow of drilling data between the wellsite and the office. The WITSML standard developed out of WITS (Wellsite Information Transfer Standard) (Jantsen et al. 1987), which has been widely used since the early 1980's. Using the standard, object oriented data is transferred as XML documents over SOAP and HTTP/S (Kirkman et al. 2003). This data transfer in the majority of cases is via an API between a WITSML Server (predominantly associated with gathering or aggregating data from the rigsite) and the WITSML Client component of a real-time enabled consuming application. Although most WITSML servers are able to work with a broad range of data objects, clients need only be configured to receive data from the objects commonly used by that application. Increasingly as bi directional flow of drilling data becomes more prevalent the need is developing for servers and some end use applications to act as both WITSML servers and WITSML clients.

Development of the standard is facilitated by the Energistics organization (formerly POSC) through a "Special Interest Group" (SIG). The SIG includes representatives from oil companies, Service Company's, software product vendors and regulatory bodies numbering around 50 member organizations currently. The activity of the SIG is split into 3 main areas.

- Steering committee :- Responsible for long term and strategic planning for the development of the standard
- Use Case & Implementation Support Team: - Effectively responsible for medium term developments and additional use case proposals to enhance the standard.

- Technical team: - Developing and maintaining the technical solution of the standard (e.g. updates to the schema).

As the standard has developed it has encompassed a growing number of data types and now with its ability to effectively pass this data between the applications and systems acquiring it to the end use applications consuming it, in real-time it has become a key enabling technology within the area of integrated drilling operations.

A Standard data delivery methodology

The value of delivering real-time FEWD data from remote drilling locations back to central offices has been proven in many locations and by many different operators over many years. (E.g. Booth and Herbert 1989, Zachariah et al. 2002) One of the issues in the past was that many of the data delivery methods were at least partly proprietary and as such have made the onward transfer of that data into end use applications a non standard and often time consuming process. The broad adoption of the WITSML standard for data transfer via dedicated WITSML servers, delivering data to applications that have been real-time enabled by the addition of a WITSML client has allowed this to become a more standardized process. This means that formalized data delivery procedures and workflows can be put in place regardless of the service company providing the data or the application vender solution on the desktop of the end data user. This in turn allowed the next major step forward to be taken by the operators with the introduction of centralized facilities to work on and with this data onshore the “onshore / operations support center” (McCann et al. 2004). This process continues across a growing number of operators in a growing number of locations around the world. Standardizing the data delivery and transfer method allows the operators to maintain an effective flow of data while having the ability to choose best in class services and software solutions from a range of vendors.

Statoil’s approach to managing this process was to establish the Real Time Support (RTS) Center team. This group have responsibility for the transfer of real-time data from all Statoil operated rigs and platforms around the world. The team centrally manages the flow of surface and downhole FEWD data from the tools and sensors at the rigsite through to the in-house project databases. This streamlined approach allows the G&G team in each asset to be confident that they will have access to new data whenever it is available. This allows them to update their models and in conjunction with their engineering colleagues update the well plan if needed as the well is being drilled.

Successful implementation of this approach across all of the asset teams in the company has identified both the interest and the need to expand this procedure to more than the purely depth based, FEWD data that was initially managed. Now the same procedure is being adopted for time based data. Initially also predominantly from drilling operations at the rigsite, it is becoming apparent that this process is applicable to other associated wellsite operations such as cementing and well testing.

For the engineers of the asset teams, the managed delivery of their data in this way brings enhanced opportunities for drilling optimization. Data that in the past may have been discarded relatively soon after the well was completed is now stored in a central database. This allows time based offset well data to be used for comparative purposes along the same lines as offset wells are used by the G&G community currently. As well as receiving the data via a standard format the historian is also able to publish the data via a WITSML server interface, allowing it to interact with the end use applications in the same way as those applications feeding data in RT during the drilling phase.

Potentially the most powerful / strategic development recently has been in the realm of cross discipline collaboration between the G&G and Engineering communities. The ability to effectively visualize combined G&G and Drilling Engineering data within applications that can be used by multiple disciplines greatly enhances the ability to collaborate. Within the WITSML standard the Risk Object enhances these workflows by enabling the transfer of data from, for example a drilling optimization package where a zone of high mechanical shock / shock risk was identified and documented to a package containing the Geological model. Within the depth based Geological model, this could then be flagged as a potential drilling risk during the well planning phase of a close offset well. This process allows for the more effective management of risk and uncertainty by ensuring that known issues from one discipline can be better incorporated into the planning and execution of the well by the whole team.

As the procedure matures and end users in the asset teams become more and more familiar with receiving their information in RT the variety of data types being requested is increasing. This brings its challenges as not all data providers at the rigsite are necessarily able to deliver their data in RT or more particularly in a WITSML format. As the need to incorporate a wider range of data types from the rigsite is realized, the role of data aggregator solutions becomes more important (Figure 1 and Karr et al, 2007). In addition some of these new data types may be unsupported by the current WITSML standard. In this case additions and changes to the standard can be accommodated by the work of the Use Case and Implementation Sub team of the SIG. Through this forum documented use cases can be developed and submitted for approval to the steering committee and for technical solutions to the technical team in order to allow them to be added to the list of data items correctly supported by the standard.

From real-time monitoring to real-time control

In addition to receiving WITSML data feeds of drilling and FEWD data to the onshore centers there has been a similar move to bring additional operations that would originally have been carried out at the rig site into the office, from the offshore environment to bring people onshore. Although not necessarily enabled directly by the use of WITSML, more by the development of remote control and monitoring tools, this trend has gone hand in hand with the development of these WITSML enabled workflows. Early examples of this process included the move of “Geosteerers” (Well Placement Engineers) into the asset team environment rather than locating them at the rigsite. This has obvious QHSE advantages but also allows these individuals to interact directly with the asset teams they are providing the service to. The next step was to look at which other services could be undertaken remotely. In the past few years within various asset teams within Statoil (now StatoilHydro) and other operators, MWD and LWD engineers as well as mud logging data engineers have been able to work remotely from the rigsite. This process obviously increases hugely the reliance on connectivity between the office and the rigsite as well as the reliability of the data transfer methods used to give these people access to the data they need to do their jobs remotely.

Towards effective Real-time data KPIs

As reliance increases on real-time data to the extent of reducing POB by enabling those individuals to undertake the work they traditionally did at the rig site from the office, the importance of having effective delivery increases. It is now not unforeseeable that a break in delivery of drilling data to the operations center would result in a halt in operations at the rigsite, with the resultant costly NPT. With rig day rates as high as they are this could very soon result in a net cancellation of any financial advantage to operating from the office rather than from the rigsite (regardless of the other QHSE and operational advantages). For this reason it is important that any data delivery service in support of these integrated operations is supported by clear KPIs for the service being delivered. Historically availability of these often web based delivery solutions has been measured relative to the availability or up time of the server or web site delivering the data. This however is only part of the story. 100% availability of a web based server indicates nothing of the quality or completeness of the data that is being delivered from that server. For this reason the adoption of the WITSML standard can be used to set realistic and measurable KPIs on data delivery from any service provider.

Table 1 indicates some suggested KPIs for WITSML delivery, and the criteria by which they could be measured. An important principle for efficient KPI’s is that they should measure availability not only on the WITSML server, but on the availability of quality real time data on the server, including the availability of server capacity to handle all operational client requests in a timely manner. As an example WITSML server performance could be gauged by measuring the time taken for the server to deliver a pre defined number of curves with a known number of data points. Whether the data is in the time or depth domain is not critical however the data density of such requests (hence the overall number of data points) is important to know. It is also important to realize that many server providers set limits on the maximum amount of data that can be polled in a single connection. This is a commonly utilized procedure to limit the effect of any poorly formed WITSML queries that may be sent to the server so that they are unlikely to adversely affect the performance of the system overall. Ideally this sort of test should be executed in addition to any routine operational load in order to best indicate the normal operational performance of the server in question.

Key Performance Indicator	Measurement criteria
WITSML service availability: Percentage of operational hours.	The average availability of the agreed WITSML services during operations. This includes the availability of the agreed real time dataset with correct quality Example (for a given operation): • GR curve or Trajectory not available in real time • ROP missing for the last 70 meters drilled. • Wrong northing reference for the trajectory • Wrong sample rate for timebased parameters between 1300 and 1700m

Period of WITSML service unavailability: Minutes	The length of the time for each instance of WITSML service unavailability during operations. Although the total availability is within the target of the previous KPI any unavailability instance should not be greater than the target of this KPI.
WITSML data quality issue response time: Minutes	WITSML data received is not according to requirements mandatory data types (e.g. well, wellbore, log (depth), log(time)) • naming of data objects (e.g. log curves) • measurement units (e.g. metric) • ·mandatory data elements and data format (e.g. time zone), data sampling rate.
WITSML server response time and throughput (performance): Seconds for measured throughput.	Maximum time for the server to complete delivery of data for a defined number of parallel WITSML client log curve requests. Each request is for a single log curve containing up to a pre defined number of data points. All requests are for different log curves. This should be executed in addition to the normal server workload.
WITSML Server update rate: Seconds	Maximum allowable time between a data point being available at the rigsite to it being available for querying from the office based WITSML Server.

Table 1. Suggested Key Performance Indicators for WITSML data delivery.

In addition to recognizing KPIs against the provider of the actual WITSML server it is equally important to have KPIs in place for whatever internal or external provider is enabling the connection between the wellsite and the office. In this way the end user network availability can be managed and any areas of poor performance identified at an early stage.

Adoption of realistic and measurable KPIs for WITSML data delivery not only allows the operator to define penalties for poor data delivery but allows for incentivised bonus's when KPIs are exceeded by the service providers.

The service company perspective

For the service companies the broader adoption of the WITSML standard for data transfer both at the rigsite and between it and town brings a number of advantages. Firstly and importantly as compared to WITS, WITSML is able to transfer a broader range of data types and therefore support the early adoption of new tools and measurement types. In addition unifying the type of data sources helps to reduce the cycle time involved with updating and developing new software solutions for acquisition and delivery. To populate the growing number of real-time enabled, internal and commercial answer products Schlumberger has adopted a unified WITSML client application that is used by all recent applications to receive data. This also helps to cut development costs and cycle time by only having to introduce changes related to developments in the standard (for example the recent release of the version 1.3.1.1 of the standard) into a single piece of code. This also helps in handling some of the current "dialect issues" related to different deployments of the standard by different vendors (Grøvik 2007).

In addition to the advantages of simplifying the transfer and handling of data between acquisition and processing / interpretation, the full adoption of the standard opens the door to make it easier to receive data from 3rd party operators and therefore to potentially offer value added services such as optimization on this data. This is of course in many ways a double edged sword as although it makes it easier for the large service companies to provide these sorts of services on their own and their competitors data, it also makes it easier for both large and small companies to target opportunities in this part of the market. One area where this is becoming increasingly important is in the area of delivering vendor neutral data aggregation services and support for drilling operations through client OSC offerings (Karr et al, 2007).

Amalgamating all relevant data regardless of source (e.g. mudlog, downhole tools, surface rig sensors etc) into the same WITSML server, this becomes the single source for both G&G and Engineering data for both the operator company team and the service company team. One example of a clear advantage of using this approach is seen between the operator and service company operations centers. In a wide range of locations worldwide, rigsite operations undertaken by Schlumberger as the FEWD provider for our clients are monitored and managed via our internal operations support centers. This brings huge service quality advantages as well as giving the remote crews access to centralized support. Recently the majority of these centers have moved to monitoring operations via a WITSML client enabled drilling optimization application. By effectively combining and visualizing time and depth based data this tool allows the engineer to undertake a wide range of safety and performance monitoring and optimization procedures. These include, automated monitoring of tripping loads, comparison of modeled and actual drag measurements, as well as automatic analysis of rig status (McLaren et al. 2007).

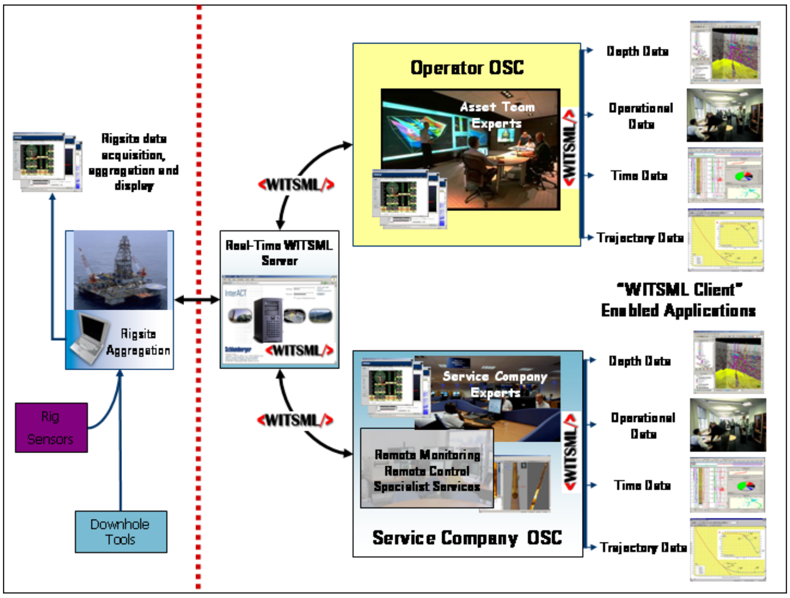

Figure 1 WITSML data flow and data consumption within Service Company and operator support centers.

This tool is fed by the same WITSML data as used by the operators internal Engineers and Geologists. As such with both user community, end use applications pulling data from the same source i.e. the WITSML server it means that any interruption or issues with the supply of this data to the server interface can be picked up and acted upon immediately by the operations support engineers. In the past data may have been coming from a variety of different sources that may or may not have been identical on both sides. This meant that on occasions issues with data feeds may not have been picked up as early as they can be now.

Figure 1 shows the interrelationship and interdependency on WITSML data between the operator and service company operation centers and the types of data driven workflows that can be enabled by adopting this approach. Although not necessarily undertaking the same analysis both centers are using the same data types from the same source making it realistic and advantageous for them both to share the same data source.

Conclusions

As WITSML becomes both more widely accepted and more widely understood it will continue to add value to the data acquired both for the operating companies and the service companies. For the operators it will bring both tighter controls on how exploration and production data workflows are managed and supported, as well as allowing their internal experts to concentrate more on their areas of expertise, than on data gathering. In addition, through the ability to work in real-time in applications that they are familiar with, Geologists and Engineers will see additional productivity gains. For the service companies it will bring both the ability to more quickly deploy new real-time enabled answer products and services as well as opening up the opportunity of providing expert services on data acquired by 3rd parties more easily than before.
However full realization of these advantages, will only come with full adoption. Currently although the number of service companies actively involved in development of the standard (via membership of the Energistics SIG) is growing rapidly, the

number of operators actively taking part is growing more slowly. Active participation in the development is a good way to ensure it delivers on current and future needs and should be encouraged. WITSML is here to stay and should be supported by the industry.

Nomenclature

FEWD – Formation Evaluation While Drilling
G&G – Geology and Geophysics
KPI – Key Performance Indicator
LWD – Logging While Drilling
MWD – Measurement While Drilling
NPT – Non Productive Time
OSC – Operation Support Center
POB – Personnel On Board
RT – Real-time
SIG – Special Interest Group
WITS – Wellsite Information Transfer Standard
WITSML – Wellsite Information Transfer Markup Language

Acknowledgements

The members of the Real Time Support team within StatoilHydro in Stavanger Norway are gratefully acknowledged for their contribution leading up to the publishing of this manuscripts along with members of the Schlumberger Operations Support Centers in Aberdeen Scotland Stavanger Norway and Perth Australia for their contributions.

References

Jantsen, H.E., Foreman, R.D., Keltner, L., and McCoy, R.S. 1987. Format, Content and Transfer Standards for Digital rigsite data. Paper SPE 16141 presented at the SPE/IADC Drilling Conference, New Orleans, U.S.A., March 15-18.

Booth, J.E., and Herbert II, J. W. 1989. Support of Drilling Operations Using a Central Computer and Communications Facility with Real-Time MWD Capability and Networked Personal Computers. Paper SPE 19127.

Grøvik, L.O. 2007 Operation Centres, Realtime Data and data Management. Quo Vadis? Paper SPE 110399 presented at the SPE Annual Technical Conference and Exhibition, Anaheim, California, U.S.A., 11-14 November.

Jantsen, H.E., Foreman, R.D., Keltner, L., and McCoy, R.S. 1987. Format, Content and Transfer Standards for Digital rigsite data. Paper SPE 16141 presented at the SPE/IADC Drilling Conference, New Orleans, U.S.A., March 15-18.

Karr, G.K., Landgren, K.M., and Fleury, S.G. 2007. End-toEnd Drilling Collaboration Infrastructure. Paper SPE 107574 presented at the SPE Digital Energy Conference and Exhibition, Houston, Texas, U.S.A., 11-12 April.

Kirkman, M.A., Symmonds, M.E., Harbinson, S.W., Shields, J.A., Will, M., and Doninger, A. 2003. Wellsite Information Transfer Standard Markup Language, WITSML, an Update. Paper SPE 84066 presented at the SPE Annual Technical Conference and Exhibition, Denver, Colorado, U.S.A., 5-8 October.

McCann, A., Omdal, S., and Nyberg, R.K. 2004. Statoil's First Onshore Support Center: The Result of New Work Processes and Technology Developed to Exploit Real-Time Data. Paper SPE 90367 presented at the SPE Annual Technical Conference and Exhibition, Houston, Texas, U.S.A., 26-29 September.

McLaren, G., Hayes M.J.S., Brown, N.M, Okafor, Z. and Megat, I. 2007. Improving the Value of Real-Time Drilling Data to Aid Collaboration, Drilling Optimization and Decision Making. Paper SPE 110563 presented at the SPE Annual Technical Conference and Exhibition, Anaheim, California, U.S.A., 11-14 November.

Zachariah, J., Ahsan, A., and Reid, I. 2002. Optimized Decision Making Through Real Time Access to Drilling and Geological Data from remote Wellsites. Paper SPE 77855 presented at the SPE Asia Pacific Oil and Gas Conference, Melbourne, Australia, 8-10 October.