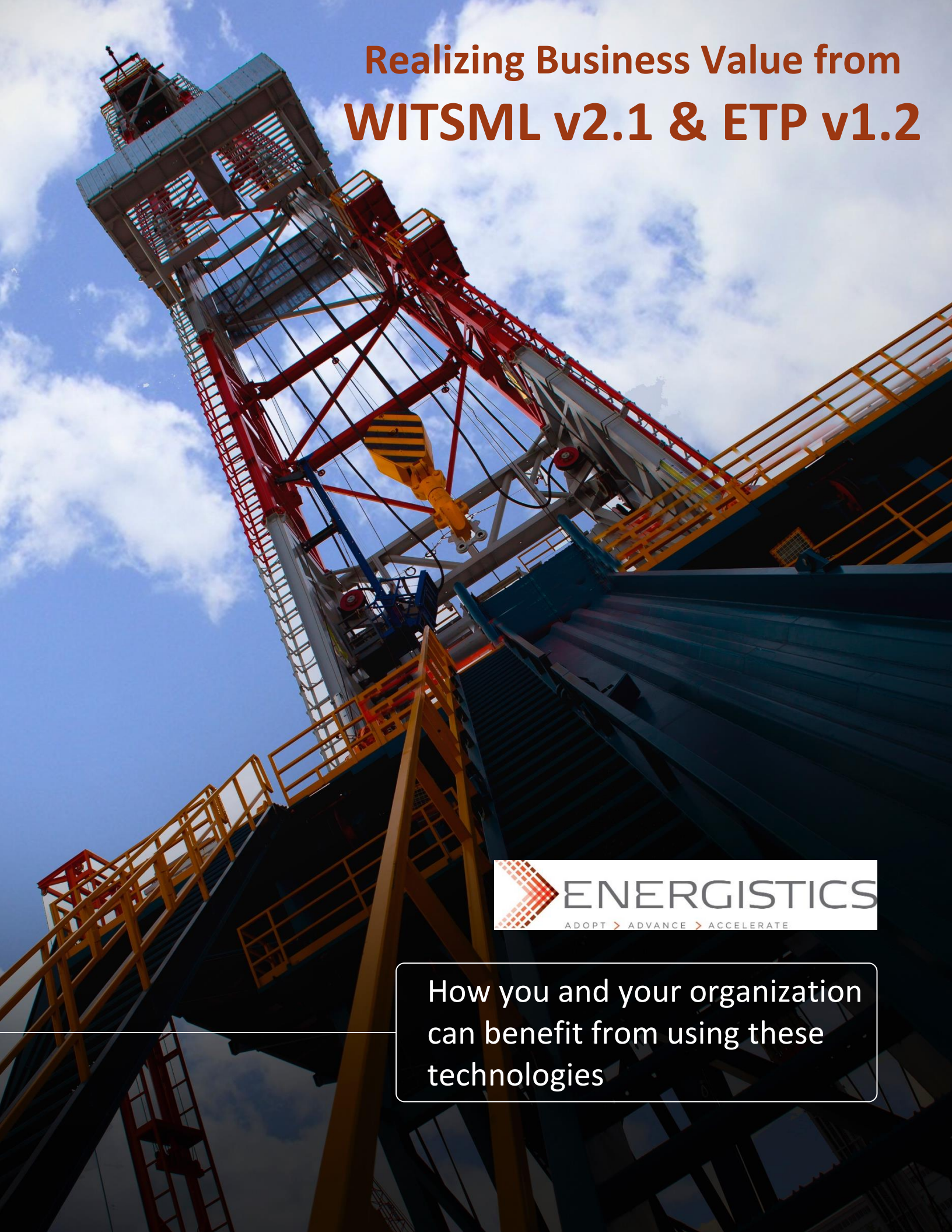
Realizing Business Value from WITSML v2.1 & ETP v1.2



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How you and your organization can benefit from using these technologies

Acknowledgements

The Energistics® Consortium wishes to acknowledge Bardasz for its valuable contributions to the research and development of WITSML™ and ETP. Their support has been instrumental in shaping the content of this technical brochure.

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How can WITSML™ v2.1 and ETP v1.2 help my drilling, completions, and interventions workflows? This is the question that this guide answers – in detail.

THIS GUIDE:

- Lists the benefits that can be achieved using WITSML v2.1 and ETP v1.2 – which are standards-based technologies that make it possible to easily share data in drilling, completion, and well intervention workflows.
- Explains how the features that produce these benefits actually work.
- Contains valuable information for business, technical, and end users.

This document has been developed by WITSML and ETP leaders, each with at least 25 years of experience in developing these standards, implementing them in software, and running operations with technology that uses them.

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THE PROBLEM: DROWNING IN DATA

For companies drilling oil and gas wells, the data acquired during those operations may be as valuable as the hydrocarbons produced from the well.

This data includes “everything” – from all operational measurements that can be conceived of, such as pressures, temperatures, and performance of equipment and tools, to the logging data for measuring a myriad of parameters used to characterize the geological formation and the hydrocarbons they may contain.

For decades, this data has been used to monitor operations, for daily reporting, and to learn lessons and improve operations on the “next well” by leveraging advanced data analytics, geological validation, and reinterpretation. Over time, requirements have grown and now the goal is for operations personnel to use this data – in real time, if possible – to ensure that the current well is successfully and safely drilled and completed according to plan, and to detect, avoid, and mitigate problems that might occur to minimize their potential negative impact.

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Barriers to Finding and Sharing Data

Modern drilling operations make it inherently difficult to quickly and efficiently share data with all necessary personnel, on and off site, because:

- Multiple vendors and the proliferation of advanced sensing technology mean huge volumes and varieties of data are being collected.
- Complex IT configurations are required, which include multiple servers on the rig site as the volumes of data from various vendors and operations are acquired, consolidated, and then used in rig-based systems, and transmitted to remote operations centers and the office.
- Operators are beginning to implement emerging cloud-based architecture, which offers new promise for storing and finding data—but initially increases complexity as the industry navigates how cloud implementations will work in oil and gas operations, and implications for integrating with or potentially replacing existing technology.

The bottom line: Everyone needs the data now. But first, organizations must be able to reliably collect the fire hose of data gushing from a myriad of sensors, structure it so it's meaningful, validate it for quality control, and then transmit and synchronize it quickly for use in all locations.

Ultimately, the data is only useful and valuable if you can find and access it when you need it, trust it when you get it, and use it reliably in the desired workflow or operations to get the right answers and the right outcomes.

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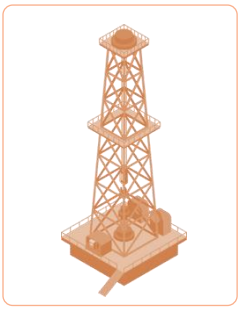
WHAT ORGANIZATIONS NEED

While improvements in data transfer, sharing, and access have been realized since the early 1990s, advancements in information technology and changing economic drivers in the last decade mean operators have had to ratchet up their requirements.

To help ensure optimal operations, organizations have said they must be able to do all the following:

- **Securely and reliably capture and manage all data from drilling, completion, and intervention operations**—which must include the ability to handle the high-frequency (about 50 Hz data rate or 20ms per data point/row), low-latency (100ms + one-way communications channel delay) data that is common in these operations.
- **Find and access that data when needed in current and future operations—no matter where it's stored.** This means solutions must be firewall and Internet friendly to meet corporate security requirements.
- **Trust that the data they get is the "right" data or the "right version" of the data**—requiring an audit trail of any changes, so that the provenance, integrity, and validity of data can be verified.



Use that data in all workflows to improve operations throughout the entire data value-chain, from the rig site to remote operations centers to the office—from data acquisition during drilling operations to real-time analysis for current operations such as directional drilling or pressure monitoring, through post-drilling analysis and use in planning and improving future operations.

For consistency and ease of implementation, solutions must be built on broadly accepted technologies and standards.

But the issues described on the previous two pages present significant challenges to meeting these goals.

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INDUSTRY-DEFINED DATA TRANSFER WITH WITSML

The WITSML data transfer format and API has been a crucial solution—and, since it was first published in the early 1990s, has become the de facto industry standard—to help organizations capture, manage, transfer, and use their drilling and well-related data. Software and technologies that implement WITSML can read and write the industry-defined standard format, thereby allowing proprietary tools and technology to easily and reliably share data.

Since its first publication, the industry has continued to evolve WITSML, working together through the anti-trust framework provided by the non-profit Energistics® Consortium, which is now affiliated under The Open Group®. The active versions of WITSML include:

WITSML v1.4.1.1. This version includes XML™[1] schemas that define the data formats and a SOAP-based API for reading, writing, and querying data. Published in 2011, this version is still widely used.

> **NOTE:** WITSML v1.3.1, introduced in 2005, is still in use but is considered obsolete and no longer supported by the Energistics community.

WITSML v2.0 and ETP v1.1. Several years ago, the Energistics Consortium transformed its data architecture, so it was consistent across all its data transfer standards (RESQML™ for earth modeling and reservoir data and PRODML™ for production data, in addition to WITSML); this transformation is referred to as the v2.0 architecture and was first published in late 2016.

In conjunction with the v2.0 architecture, members developed the Energistics Transfer Protocol (ETP), an API for use with all Energistics v2.0 data transfer standards. ETP is based on the WebSocket protocol, which addresses problems with SOAP-based APIs.

WITSML v2.1 and ETP v1.2. These are the most recent versions, with WITSML v2.1 published in May 2022 and ETP v1.2 in October 2021. These versions are the culmination of WITSML development and are the recommended solution going forward. Further updates will be done only if the industry requests them or if issues are discovered that must be corrected. The new capabilities and related business value are described on the next page.

[1] XML is a trademark of the World Wide Web Consortium (W3C®).

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THE NEW POWER OF WITSML v2.1 AND ETP v1.2

These latest versions now make it possible to perform all functionality that was available in WITSML v1.4.1.1, only faster and more efficiently, with improved data object design and the updated ETP built on the WebSocket protocol, while also reducing the resources needed for data preparation and validation. (For more information on how ETP works, see page 23.)

Additionally, new functionality has been added for high-speed, real-time data streaming, endpoint authorization, recovery from unplanned outages that reduce the need to "restream the entire well", and more.

Across the world, adoption of WITSML and ETP has grown significantly, as more companies in the industry take advantage of the benefits that these capabilities add to their applications and operations. There are literally scores of benefits to be discussed, which go beyond the scope of this document. However, here are highlights of some of the highest-value benefits that most organizations can expect to realize:

- **Enhanced security and authorization** to meet today's more stringent requirements.
- **Improved data quality,** which comprises these factors:
  - Reliability: The data accurately represents what is happening at the rig site.
  - Availability: Personnel have access to the desired data on demand.
  - Integrity: Both the original, raw data and the values derived from it are retained.

  These factors combined mean WITSML and ETP deliver data that people can trust. That is, they have confidence in the data when they receive it, when they act on it, and in the decisions and results based on it.
- **Complete data management for a variety of data objects** through the life cycle of a well. WITSML defines 28 data objects that cover workflows for drilling operations and related reporting, logging and mud logging, and completions and interventions.
- **Fast, reliable streaming that delivers faster decision-making** for current operations through real-time analytics. ETP has made possible what SOAP-based WITSML could not: true real-time streaming. An order of magnitude faster and more efficient than SOAP, ETP delivers fast, accurate, reliable, and secure real-time streaming through the Internet or corporate networks so that data can be shared almost instantly with anyone involved in an operation, whether in the operator's organization or a service provider, so that everyone is informed and aware of progress.
- **Increased safety with fewer personnel required at the rig site** because the improved performance of WITSML and ETP better supports remote operations.

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Comparing Versions of WITSML

While WITSML v1.4.1.1 is still in use today, WITSML v2.1 with ETP v1.2 address the main challenges of the older version as shown in the following table.

Industry Needs	WITSML v1.4/SOAP	WITSML v2.1/ETP v1.2
Meets corporate security requirements, such as multi-factor authentication.	☹ **Exception required**	☺
Provides an audit trail of changes (improves efficiency and sync of changes).	😐 **Implementation complex**	☺
Handles high-frequency data with low latency.	☹	☺
Compatible with the OSDU® Data Platform.	☹	☺

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HOW THESE BENEFITS ARE ACHIEVED

This section provides highlights of how WITSML v2.1 and ETP v1.2 deliver the benefits described above.

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Enhanced Security and Authorization

ETP v1.1 supported Basic Authentication and the use of JSON Web Tokens (JWT). At the explicit request of oil companies, security and authorization have been dramatically upgraded in ETP v1.2. Now any type of bearer token can be used (not only JWT); Basic Authentication is NOT recommended.

How it Works: Security for ETP leverages relevant parts of existing security standards to specify an approach that is based on existing best practices and can provide minimum standard requirements. The basic concepts in the ETP security scheme:

- It allows authorization to happen at the ETP application layer instead of, OR in addition to, the HTTP transport layer.
- It supports authorization workflows for both endpoints in an ETP session. The specification requires that a client authorizes with a server. Optionally, a client may require a server to authorize.
- It requires an access token, which is a bearer token issued by an authorization service that authorizes access to a specific resource. The bearer does not know the contents of the access token, nor does it need to; the bearer only needs to know how to get the access token and present it to the resource that it needs access to.
- It requires an authorization server, which issues access tokens for an ETP endpoint. An authorization server may be separate from the ETP endpoint and may have a different authority, or it may be a relative URI to the ETP endpoint.

Benefits: This enhanced standards-based authentication at the application level delivers stronger standard security "built into" ETP; it allows individual implementers to add custom enhanced functionality, and makes it easier enhance ETP security in the future.

Who Benefits: Any company that wants to protect its sensitive commercial data but still needs to provide access to that data from nearly anywhere in the world.

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Improved Data Quality

WITSML v2.1 and ETP v1.2 include features that help users have confidence and trust in data before acting on it. Use of these features can reduce time and resources needed in data preparation and validation, which includes establishing trust that data is fit for purpose. These features include:

Standard Identification and Traceability Metadata

Each instance of a data object has standard identification and traceability metadata that specifies the unique identifier (UUID), data object alias(es), creator, editor (which include people and software), related dates, and more. With the complex IT environments inherent to oil and gas operations (described above), it's quite common for the same data objects to exist in many systems. People in all roles along these workflows must be able to determine which data object they are currently working with – and if it's the right one.

How it Works: By definition in WITSML (enforced by schema design), a data object must inherit from a model construct named Abstract, which includes an element named Citation; these constructs provide the data fields to capture this information for each instance of a data object.

Example: If faced with two instances of data objects with the same UUID, you can use the metadata in each—such as the date the data object was created and when it was last updated—to determine which version is the most recent or the version that is fit for purpose for your particular task (maybe you don't need the most recent version).

Benefits: Any users of the data in any workflow can use this metadata to determine the specific identity of a data object and some of its basic history, such as when it was created, last updated, by whom, and by what software.

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Activity Model

The Activity Model makes it possible to capture the data about the activities or functions performed on a data object, and for this activity information to be transferred with the data object.

How it Works: The Activity Model lets users define activities and tasks that may be done to other data objects. The defined activities and tasks depend on the referenced data object and what can actually be done to it in the real world. The data object can then reference the activity, and the activity can be transferred with the data object it references. Like a Data Assurance data object, an Activity data object is a "decorator" data object; that is, it must always reference another data object.

Benefits: The receiver of the data can better understand the data object and how it was created or derived. In the previous example, a drilling engineer would understand that a Channel data object was actually "spliced together" from several different Channel data objects and be able to see the "source" Channels and the from/to depths where each source Channel was used.

Example: In WITSML, for a log Channel data object, a user can specify if the Channel has been created choosing options such as simulated, spliced or sampled. Using the Activity Model, the user can describe the activities, people, and processes used to create the Channel, and transfer that activity data with the data object.

Who Benefits: Data management teams who prepare data for technical workflows and analysis.

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Standard Response Messages

Standard response messages in ETP v1.2 improve operational efficiency and data management by ensuring new data is received as soon as it's available. Based on operational experience with earlier versions of ETP, in v1.2, some request messages now require response messages.

How it Works: The ETP v1.2 specification specifies the request messages that require response messages and the name of the required response message(s). These request/response rules must be observed by anyone developing ETP v1.2 server or client applications.

Benefits: This confirmation ensures the receiver is aware that the subscription has been correctly established. Even if the receiver does not immediately start receiving data, it can be confident that the subscription is established, but the Channel may not be producing data at the moment.

Example: When a client requests from a server to SubscribeChannels (that is, it wants to receive any data for a specified set of Channel data objects), and when the server has successfully set up the "subscription", it must respond to the client with a SubscribeChannelResponse message (or an error message) indicating the subscriptions that were established or any errors that occurred.

Who Benefits: Data acquisition and operations personnel at the wellsite.

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Active Flags

WITSML has the notion of “active” data objects, which are data objects where updates are currently being made to the data object itself or to other data objects related to it.

For Channels and growing data objects, this field reflects updates to the data object’s data points or parts, respectively.

For wellbores, this field reflects updates to Channels or growing data objects associated with the wellbore.

The relevant data objects have a status element to reflect if it is active. For many versions, WITSML has had active status on wellbore, log, trajectory, and mud log. In WITSML v2.1 active status fields have been added to other data objects, such as well, a rig, and log channel set.

How it Works: ETP maps the WITSML active status field to the active status field on the Resource record in ETP, so that ETP-enabled applications can use it in workflows to determine sources of new data.

Example: When a client application connects to an ETP endpoint that is producing data, the client can use the active status field to determine which data objects are currently actively producing data—and confidently ignore the data objects that are not.

Benefits: In some cases, data providers are making data available for multiple operations, multiple wells, etc. Having these active flags filters out a lot of noise, saving time and money to find the right data.

Who Benefits: Data providers who are tasked with aggregated operations data and may be responsible for hundreds or thousands of active data sources.

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Data Assurance

The Data Assurance data object indicates non-conformance of data in another data object that it references (e.g., a trajectory station, or data value in a log channel, etc.) with a pre-defined data assurance policy.

How it Works: Business rules specified between the data provider and consumer can be used to check data and automatically flag data that does not comply; the non-compliance data (e.g., the rule that was broken) is sent in the Data Assurance object. A Data Assurance data object must always reference another data object (it makes no sense by itself) so it is referred to informally as a "decorator" data object. The Data Assurance object can be transferred with the data object (for example, a log channel or mud log) that it is describing.

Benefits: The recipient of the data is notified that data is noncompliant and can take some action or decide not to use the data. For example, if a sensor is operating out of range over a set of recently received points, the data producer may be able to properly calibrate the sensor.

Example: It can be used to indicate factors about data such as: is a sensor operating out of range, is a piece of equipment improperly calibrated, or is data out of compliance with contractual provisions.

Who Benefits: End users in planning and post-job analysis workflows such as drilling engineers, or data managers in a QC workflow. The Data Assurance information can be passed on to subsequent steps in the workflow, thus reducing or eliminating data validation checks that are typically repeated at each step in the workflow.

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Features for Easier "Catch Up" after a Network Outage

Unplanned network outages are common in offshore and remote operations. When the network connection resumes, the main questions are: where did we leave off and what data have we missed? Often the only way to be sure that you receive all data is to re-stream the entire data object (for example, a log channel or mud log) from the very beginning—which of course is time consuming and costly.

ETP v1.2 includes new features that make it possible for a client and server engaged in an operation that unexpectedly ends to recover with a significantly reduced likelihood of having to "resend all data again". These new features also:

- Support better decision-making around when it is necessary to resend everything.
- Allow a user to choose between "start from the beginning" or "send me the latest data first and backfill the older data later".

Several features in ETP make these workflows possible, which include:

- Change Annotation, which is an ETP data structure that describes a range of data that has changed (historical data changes) to Channel and growing data objects in a store; it includes the inclusive range of data affected by the change and the timestamp associated with the change.
- ETP timestamps that are exchanged when an ETP session is established and during a session when data objects are added, updated, or deleted.
- Change Retention Period (CRP), which is the minimum time period that a store retains the identifier of a deleted data object and any change annotations for data objects, including channels and growing data objects. (The ETP specification requires a minimum CRP of 24 hours. If the period is shorter, the risk is that additional data will need to be transmitted to recover from outages, leading to higher initial load on sessions.)

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How it Works: An ETP store uses time stamps and change annotation data to track changes to data objects (additions, deletions, and updates). When a store and store customer are connected in an ETP session, the customer can receive notifications of these changes as they are happening, which includes the timestamps when the change occurred in the store.

When a customer reconnects to a store, it can request change annotations to help understand what has changed while it was disconnected, compare that information to the change information that it has, and determine necessary actions based on the information.

Example: A customer is connected to a store that is streaming channel data to it. The connection is lost. When the customer reconnects, it can compare the last channel index it has data for and the change annotation data. If the last index was 900 ft and the store is now sending data points at 1,200 ft, the user at the customer end can choose among several standard ETP options, such as: start streaming at 900 ft or start streaming at the current index (1,200 ft) and the customer can then retrieve the “missing data” (900 to 1,200 ft) later.

Benefits: These new features give end users more options and more information for better decisions on which options to choose when recovering from network outages. These features also dramatically increase the reliability of getting “all the data” in less time.

Who Benefits: Data providers who are tasked with aggregating operations data and may be responsible for hundreds or thousands of active data sources.

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Complete Data Management

WITSML v2.1 includes some significant improvements to data object designs and ETP v1.2 includes 1.4.1.1-equivalent—or significantly improved—functionality and features to store, retrieve, edit, delete, and query the data objects.

Redesigned Log Data Object

Within the industry, it is common to informally refer to "log data" as though it's "one thing". It's easy for outsiders or newcomers to miss the fact that what is meant by "log data" comprises a diverse set of data, collected from a diverse set of tools, that is acquired in the field, used in current and multiple operations along the entire exploration and production workflow—over decades—and must be accurately acquired and managed over those decades.

In the v2.0 architecture, the Log data object was overhauled to be a "complete" Energistics data object, with the standard identification and traceability metadata described above (in WITSML v1.4.1.1, logs existed only in the context of a wellbore).

How it Works: In the new design, a Channel data object is a single curve (index and value) which a user may aggregate into ChannelSets; ChannelSets can be aggregated into Logs.

This powerful new design better reflects how industry professionals typically work with log data and supports better data management and reuse practices. Each Channel, Channel Set, and Log is a WITSML data object, and, as described above, has the identifying data and metadata that make it possible for users to differentiate instances and versions of the same data object. Also, the Data Assurance and Activity Model data objects can be used to "decorate" Channels, Channel Sets, and Logs.

Example: When creating Field Development Plans (FDPs), G&G and engineering professionals use existing log data from similar geological formations or existing similar operational conditions (e.g., similar types of hydrocarbons, such as heavy oil) to develop hypotheses and inform the design for the current FDP. As they use this existing log data, they can rely on the identification and traceability metadata to know the identity of the initial source data, and they can use the Activity Model to keep track of how, why, and by whom, the Channels have been combined into Channel Sets and Logs for the FDP they are developing.

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Benefits: The knowledge of the source data and the ability to capture the analysis and decision metadata (in the Activity Model) and store it with the data, saves people time. It's not uncommon for FDPs to start, then be put on hold and resurrected months or years later—with new personnel. Using the new capabilities of the WITSML v2.1 data objects, personnel who pick up the project can quickly and easily understand the previous work.

Who Benefits: G&G and engineering professionals who need to understand previous analyses and decisions.

Latest Version of PWLS with More Features

The Practical Well Log Standard (PWLS) provides an industry-agreed list of logging tool classes and a hierarchy of measurement properties and applies all known log mnemonics to them. Specifically, it lists properties, logging tools, codes (vendor mnemonics), and mappings of relationships among them.

WITSML has long supported the PWLS property hierarchy. WITSML v2.1 now includes support for PWLS tool and curve data.

How it Works: When PWLS information is implemented in stores or software, it supports queries over large populations of log data, making it easier for oil and gas professionals to find and use valuable log data.

Example: PWLS makes it possible to do queries such as "give me all the gamma ray logs" and have a store return all gamma ray logs (channels), from all vendors, regardless of the variety of vendor mnemonics used to identify gamma ray data. In WITSML v2.1, you can now limit that search further by specifying one or more tool classes, such as "AGR" for array gamma ray tools or "SGR" for spectral gamma ray tools.

Benefits: These improvements make it easier to query property data and associate curves with the tool that acquired them.

Who Benefits: Data consumers—any end user that needs to find and use property data.

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Harmonized Growing Data Object Design

Inherent in drilling operations is the concept of “growing data objects”. As an operation continues over time (drilling, logging, etc.), new data points are added that cause the data object to grow. Any software that handles these data objects must be able to manage the data object and its related set of parts.

While the concept of a growing data object has always been part of WITSML, how they have been modeled has changed over time. From WITSML v2.0 to v2.1, the designs of the various growing data objects have been harmonized so they are similar and function consistently.

How It Works: In WITSML v2.1, growing data objects include:

- Trajectory whose parts are the trajectory stations.
- Wellbore Geometry (casing string) whose parts are wellbore geometry intervals.
- Wellbore Geology (previously known as a mud log): in WITSL v2.1, this covers the three main data objects that comprise Wellbore Geology that are now each growing data objects, which include: cuttings geology, interpreted geology, and show evaluation.

The keys to harmonization were both in how the individual parts are defined and managed.

Improved design comes from a schema change in WITSML v2.1 that makes it easier to manage one or more parts more like independent data objects—but not with the "overhead" of an independent data object, which is NOT needed because parts only exist and make sense in the context of a “parent” data object. Also, active flags and index metadata have been added.

Improved management comes from significant upgrades in the growing data object sub-protocol (Protocol 6) in ETP v1.2. Where it makes sense, Protocol 6 functions similarly to data object handling in the Store sub-protocol (Protocol 4) and it can better handle more use cases.

Example: Now, operations personnel for a data acquisition company can create an empty Trajectory or Wellbore Geology data object and use the metadata to broadcast the unit of measure for the MD (e.g., feet or meters) for the data that will be produced, which allows other endpoints that may be receiving the data to better prepare to receive that data.

Benefits: The approach described in the example allows the receiving endpoint to establish business rules to help with data quality (e.g., that individual data points sent must have consistent UOM to the advertised metadata). This functionality eliminates the phone calls that are now commonly required to resolve such issues.

Who Benefits: In the example above, both data senders and data receivers benefit. The consistency across all growing data object designs makes it easy for developers to implement growing data objects and easier for end users to work with them.

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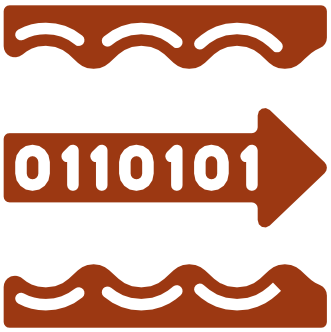
Fast, Reliable Streaming with ETP

The Energistics Transfer Protocol is the API for acting on data—adding, deleting, updating, streaming, etc.—for WITSML and the other Energistics v2.0 architecture data models, RESQML and PRODML.

NOTE: For easier implementation of ETP v1.2 (the latest and recommended version) in a .NET environment, you can download the ETP Developer Kit (DevKit) by clicking here.



ETP is comprised of sub-protocols that focus on specific functionality and were designed based on well-known software engineering principles such as "single responsibility" and "don't repeat yourself". For example, Protocol 0 is the ETP sub-protocol for establishing and securing an ETP session, and it is the only sub-protocol that must be implemented. Protocol 6 specifies the functionality for handling the "parts" of growing data objects; if an application implementing ETP does not handle growing data objects, Protocol 6 does not have to be implemented.

Within the sub-protocols communication happens through the exchange of messages that are specifically designed for the sub-protocol function. The messages have been deliberately designed to be small and send the least amount of data possible. The message design also includes features for how to handle the large volumes of data involved in some operations.

The overall design of ETP (e.g., WebSocket, functionality-based sub-protocols, small messages, etc.) contributes to its speed and performance. Think of it as being like Netflix® or Hulu®[2] for real-time oilfield data!

Additionally, WITSML v2.1 allows for delivery of data in both XML and JSON encoding. This fact coupled with the speed of transfer opens the possibilities for advanced analytics in real time, and the possibility of delivering drilling and completion engineers more tools for better, faster decision-making, and reduces operational costs (De la Rosa and Farnan, 2022).[3]

[2] Netflix is a registered trademark of Netflix, Inc.; Hulu is a registered trademark of Hulu, LLC.

[3] Refer to: de la Rosa, Cesar and Farnan, Mark, Benefits of ETP 1.2 and WITSML 2.x in Drilling Operations; presentation at the Congreso Mexicano del Petróleo (CMP), 6-9 July 2022

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How it Works: ETP is based on WebSocket, a communication protocol standardized by the Internet Engineering Task Force (IETF®[4]) RFC 6455.[5] WebSocket allows full-duplex communication over a TCP channel. This means it's possible for a client and server to have secure, interactive, two-way communication—including receipt of responses to event-driven actions, without the client having to poll the server (Note: This functionality eliminates a crucial problem with SOAP-based APIs).

In a pilot test of an earlier version of ETP, data was transferred 10 times faster and used just 1/10 of the bandwidth compared to SOAP- based WITSML 1.4.1.1.

Example: ETP makes it possible for one endpoint (e.g., a store) to create a "subscription"—a long-lived, secure connection—to one or more data objects in an endpoint that produces data (e.g., a sensor). If the ETP session and subscription are active, when the endpoint produces data, the other endpoint will receive it.

Benefits: ETP delivers “real”, reliable real-time streaming, with latency so low, that even from offshore wells to onshore remote operations centers, the resulting data transmission is as “good as being there”. The underlying WebSocket protocol makes "subscriptions" possible, which eliminates the need for endless polling, thereby reducing network traffic in operations where bandwidth can be severely limited.

[4] IETF is a registered trademark of the IETF Trust.

[5] Refer to: https://datatracker.ietf.org/doc/html/rfc6455.

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Increased Safety with Fewer Personnel on the Rig

In drilling operations, minutes make a difference. ETP's real-time streaming allows faster resolution of data anomalies and improved collaboration because all personnel—whether onsite or in remote operations centers—are seeing the same data. Because of this instant data sharing, problems can be solved faster and with fewer trips to the rig. Data can also be instantly shared with other service providers in the ecosystem, thus ensuring that everyone involved in the well is seeing the same data at the same time.

For example, for directional drilling engineers, changing the trajectory of a wellbore is not something that "turns on a dime", so close monitoring of toolface orientation is crucial for hitting desired targets and keeping a wellbore on track.

With true real-time streaming, drilling engineers who are now frequently located in remote operations centers, can keep the required close watch on this and other parameters of an operation and respond as quickly as if on site.

Many other experts can also perform their jobs from the safety of a centralized operations center. This means increased safety with fewer people required on the rig, and that these few skilled experts can support multiple projects from a single location.

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CONCLUSION

For more than 30 years, WITSML has been helping industry companies solve issues for drilling and well-related operations workflows and related data management, which have allowed them to lower operational costs and minimize risks. The latest versions, WITSML v2.1 and ETP v1.2, include innovations that will address the latest challenges and achieve the desired results and benefits that the industry needs in an increasingly complex environment, ensuring data quality, reliability, and performance across the industry.

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