Industry Standards and Certification

The Drilling Systems Automation Roadmap Certification and Industry standards provides insights on the many standards already available for automation application.

Table of Contents

Development Team

Mark Anderson, Shell, Leader

Functional Description

Automated drilling systems must be designed for safe and cost-effective implementation and operation. Standards from recognized industry organizations that are applied to other industrial automation systems are available for drilling systems automation (DSA) application. Certification systems are available but have not yet been adopted in DSA. Applicable regulations that require particular conformance to standards and obtainment of particular certifications must be met. Standards assist interoperability between various components of automated drilling systems.It will be critical for the oil and gas drillling industry to adopt suitable and recognized standards for the implementation of DSA. This will ensure customers' systems are capable of performing as promised, especially in situations where interoperability is required to deliver a planned output.

Performance targets

Technology development and implementation may occur before the standards, certification and regulation are applied. However this need not be the case because a number of standards exist in other domains. The multitude of standards already in place from other industrial applications may be sufficient such that no new standards need to be created for successful DSA implementation. Bendefits or the oil and gas drilling industry adopting automation standards that have been established in industrial automation include:

- Lower installation and startup costs
- Reduced inventories of bespoke equipment
- Enable component interchangeability
- Improve design
- Increase safety
- Increase security
- Practical application of expert knowledge achieved in another industry
- Harness years of experience and avoids the need to start each project from the beginning.

Unquantified valuable performance targets may be delivered from by standardization.
Standards have been shown to support operational excellence through:

- Improved performance
- Lowered maintenance costs
- Reduced downtime
- Enhanced operability.

Current Situation

Many standards applicable to industrial automation are already available including those from known and recognized organizations, such as ISA and IEEE alarm systems, HMI, enterprise and control systems interfaces, batch and continuous process.

A list of known standards applicable to DSA is shown in Appendix A. This list includes known relevant standards, and the identification, name and a brief description of the standard.

Some standards are more important than others for the development and application of DSA and the following have been identified as the most important for initial application to DSA:

12 of 14: Industry Standards and Certification

- ISA18alarm systems
- ISA101—human machine interface
- ISA95—enterprise / control systems interface
- ISA99—security
- ISA84—safety systems
- ISA88—batch
- ISA100—wireless systems
- ISO 13849-1—machinery safety,safety related parts of control system and general principles
- ISO 13849-2—Machinery Safety,Safety related parts of control system, and vvalidation
- Q1 and Q2—API quality system standards that enable organizations to demonstrate an ability to meet quality requirement levels.

Problem Statement

Many standards that apply to automation, exist outside the realm of drilling and are relevant to the industrial application of automation. Identifying and applying these standards is an opportunity for the oil and gas drilling industry as the drilling industry forms a basis for ensuring deterministic and proven systems and data output.

The oil and gas drilling industry has traditionally relied upon standards provided by such organizations as API and Energistics. Machine level control systems designers and implementers have have sused global standards. The challenge facing the industry is to identify and articulate those standards that will enhance the values for drilling automation and enable greater collaboration for more value through interoperability at the equipment and process level. Applications are being developed at the platform level that connects to a bespoke control system for the drilling rig.

Barriers

Because open system connectivity is in conflict with the closed system competitive advantage view of its internal culture, the drilling industry may resist adopting standards from outside the industry or standards that create interoperability.

Needs

Standards have been proven to deliver reduced costs of implementation by allowing operators to cost effectively and safely design, implement and operate components of an automated drilling system. Standards facilitate cost reductions by lowering the cost of entry of actuators, sensors and algorithms through plug-and-play systems that. Architecture standards and interoperability provides a means by which products from different vendors can come together more fluidly.

12 of 14: Industry Standards and Certification

Certification needs include verification and grading of state engines and verifying, validating, certifying and benchmarking models. Sensors must meet requirements of accuracy, maintenance an calibration.

Critical success factors

The rate at which the drilling industry is willing to identify and agree to the adoption of standards that already exist is critical to the success of DSA. The sooner this comes about, the earlier a foundation of interoperability can be established.

The challenge is for the industry to coalesce around a small set of fit-for-propose standards and certifications. Also, while existing standards may have to be expanded or elaborated upon to meet the challenges of automated drilling, from an economics-ofscale viewpoint the use of existing ones provides lower cost compared with creating new standards and certifications.

Way Ahead

As the industry educates itself on available standards and their applicability, many of which are described in the Appendices to this section of the DSA Roadmap, standards adoption will progress. Subsequently, a recognized industry body may become the guardian of the list of applicable and recognized standards.

Convincing the industry to adopt relevant existing standards from recognized standards organizations may occur haphazardly as systems engineers apply standards familiar to them while organizations do not formally attribute these standards.

The industry will benefit from a formal process to identify the critical systems that require certification, which will include the many models being offered for process support. This certification application will reduce risk of implementation. This will require the industry to identify a recognized organization, or industry body, that can take ownership of the program to develop testing and to certify these various systems and models.

The way ahead will include maintaining the lists in Appendix I and II as evergreen.

Appendix I - Industry Standards

Standard	Name of standard	Brief description and comments
ISA5.1	Instrumentation Symbols and Identification	The standard is suitable for use whenever any reference to an instrument is required in the chemical, petroleum, power generation, air conditioning, metal refining, and numerous other industries. The standard is intended to provide sufficient information to enable anyone reading a flow diagram and having a reasonable amount of plant knowledge to understand the means of measurement and control of the process without having to go into the details of the instrumentation that require the knowledge of an instrument specialist. - See more at: https://www.isa.org/isa5-1
ISA18 (family of 5 standards)	Instrument Signals and Alarms	The purpose of this standard is to establish terminology and practices for alarm systems, including the definition, design, installation, operation, maintenance and modification and work processes recommended to effectively maintain an alarm system over time. - See more at: https://www.isa.org/isa18
ISA20	Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves	These forms are intended to help specification writers present basic information. In this sense, they are "short-form" specifications or "check sheets" and may not include all necessary engineering data or definitions of application requirements. While the types of instruments described by these forms are more common to the process industries, the forms should also prove useful in other areas if special requirements are defined elsewhere.
ISA84	Safety Instrumented Systems	Safety instrumented systems have been used for many years to perform in the process industries. If it is to be used effectively for safety instrumented functions, it is essential that this instrumentation achieves certain minimum standards and performance levels. This international standard addresses the application of safety instrumented systems for the process industries. It also deals with the interface between safety instrumented systems and other safety systems by requiring a process hazard and risk assessment. The safety instrumented system includes sensors, logic

		solvers and final elements. This international standard has two concepts, which are fundamental to its application: safety lifecycle and safety integrity levels. The safety lifecycle forms the central framework, which links together most of the concepts in this international standard.
IEC 61508	Functional Safety of Electrical,Electronic and Programmable Electronic Safety-related Systems (E/E/PE, or E/E/PES).	IEC 61508 is an international standard of rules applied in industry. It is intended to be a basic functional safety standard applicable to all types of industries. It defines functional safety as “part of the overall safety relating to the EUC (Equipment Under Control) and the EUC control system, which depends on the correct functioning of the E/E/PE safety-related systems, other technology safety-related systems and external risk reduction facilities.” The standard covers the complete safety life cycle and may need interpretation to develop sector specific standards. It has its origins in the process control industry.
IEC 61511	Functional safety - Safety instrumented systems for the process industry sector	IEC 61511 is a technical standard which sets out practices in the engineering of systems that ensure the safety of an industrial process through the use of instrumentation. Such systems are referred to as Safety Instrumented Systems.
IEC 62061	Safety of machinery: Functional safety of electrical, electronic and programmable electronic control systems	IEC/EN 62061,” Safety of machinery: Functional safety of electrical, electronic and programmable electronic control systems,” is the machinery specific implementation of IEC/EN 61508. It provides requirements that are applicable to the system level design of all types of machinery safety-related electrical control systems and also for the design of non-complex subsystems or devices.
ISO 13849	Safety of machinery -- Safety-related parts of control systems	ISO 13849 is a safety standard which deals with safety-related design principles of employed control systems.[1] It replaced EN 954-1 in December 2011.[2] Part 1 defines the general principles for design and part 2 describes the validation.

ANSI/ISA-88	Batch Control	ANSI/ISA-88 (S88)) provides a consistent set of standards and terminology for batch control and defines the physical model, procedures and recipes (repeated defined processes). The standard addresses the lack of a universal model for batch control, difficulty in communicating user requirement, integration among batch automation suppliers and difficulty in batch control configuration. The standard defines a process model which consists of a process which consists of an ordered set of process stages, which consist of an ordered set of process operations that which consist of an ordered set of process actions. The physical model begins with the enterprise, which must contain a site that may contain areas. These areas may contain process cells that must contain a unit. The unit may contain equipment modules and may contain control modules. Some of these levels may be excluded, but the unit may not be excluded. The procedural control model consists of recipe procedures, which consist of an ordered set of unit procedures. These procedures consist of an ordered set of operations that consist of an ordered set of phases. Some of these levels may be excluded. Recipes may have general, site, master or control types. The contents of the recipe include header, formula, equipment requirements, procedure and other information necessary to make the recipe.
ANSI/ISA95	Enterprise-Control System Integration (contains the "Purdue Reference Model")	ANSI/ISA-95, commonly referred to as ISA-95, is an international standard for developing an automated interface between enterprise and control systems. This standard has been developed for global manufacturers to be applied in all industries, and in all types of processes, such as batch processes, continuous and repetitive processes. The objectives of ISA-95 are to provide consistent terminology that is a foundation for supplier and manufacturer communications, and to provide consistent information and opertaion models that are foundations for clarifying application functionality and how information is to be used.
ISA99 / ANSI/ISA-62443	Industrial Automation and Control Systems Security	These documents were originally referred to as ANSI/ISA-99 or ISA99 standards and were renumbered in 2010 to be the ANSI/ISA-62443 series. All ISA-62443 standards and technical reports are organized into four general categories labeled General, Policies and Procedures, System and Component. Th General category includes common or foundational information, such as concepts, models and terminology. Also included in this category are work products that describe security metrics and security life cycles for IACS. The Policies and Procedures category of work products targets the asset owner. These address various aspects of creating and maintaining an effective IACS security program.

		The Sysgtems category includes work products that describe system design guidance and requirements for the secure integration of control systems. Core in this is the zone and conduit design model. The Component category includes work products that describe the specific product development and technical requirements of control system products. This is primarily intended for control product vendors but can be used by integrator and asset owners for to assist in the procurement of secure products.
ISA100	Wireless Systems for Automation	The ISA100 Committee addresses wireless manufacturing and control systems in the areas of the: Environment in which the wireless technology is deployed Technology and life cycle for wireless equipment and systems Application of Wireless technology The wireless environment includes; the definition of wireless, radio frequencies (starting point), vibration, temperature, humidity, EMC, interoperability, coexistence with existing systems, and physical equipment location. - See more at: https://www.isa.org/isa100
ISA101	Human-Machine Interfaces	The standards, recommended practices and technical reports developed by ISA101 will be directed to those responsible for designing, implementing, using, or managing human-machine interfaces in manufacturing applications. Unless noted otherwise in a specific ISA101 document, the documents will apply to all manufacturing industries. The areas covered within ISA101 includes menu hierarchies, screen navigation conventions, graphics and color conventions, dynamic elements, alarming conventions, security methods and electronic signature attributes, interfaces with background programming and historical databases, popup conventions, help screens and methods used to work with alarms, program object interfaces, and configuration interfaces to databases, servers, and networks. - See more at: https://www.isa.org/isa101
ISA106	Procedure Automation for Continuous Process Operations	The sScope of Technical report provides a common basis of benefits understanding, best practices application and language, including terms and definitions, that allows application of procedural automation across the continuous process industries. In agreement with the scope of the ISA106 Committee, this technical report focuses on automated procedures that primarily reside on systems within the supervisory control, monitoring and automated process control section of the production process. It is not the intent of the committee to have this technical report focus on procedure execution at the operations management functional level. See https://web-material3.yokogawa.com/ISA_106_TR1_Infographic.us.pdf

12 of 14: Industry Standards and Certification

ISA-SP99 (ISA/IEC 62443)	Series of Standards on Industrial Automation and Control Systems (IACS) Security	The ISA99 Committee will establish standards, recommended practices, technical reports and related information that will define procedures for implementing electronically secure manufacturing and control systems and security practices and assessing electronic security performance. Guidance is directed towards those responsible for designing, implementing or managing manufacturing and control systems and shall also apply to users, system integrators, security practitioners and control systems manufacturers and vendors. See more at: https://www.isa.org/isa99
NIST 800 (series)	Special Publications of the Computer Security Division's (CSD) Computer Security Resource Center (CSRC)	Special Publications in the 1990 800 series are of general interest to the computer security community. This series reports on ITL's research, guidelines and outreach efforts in computer security, and its collaborative activities with industry, government and academic organizations. - See more at: http://csrc.nist.gov/publications/PubsSPs.html
IEC 61158	Digital data communications for measurement and control – Fieldbus for use in industrial control systems	Fieldbus is the name of a family of industrial computer network protocols used for real-time distributed control, which has been standardized as IEC 61158. A complex automated industrial system, such as a manufacturing assembly line, typically requires a distributed control system, an organized hierarchy of controller systems, to function. In this hierarchy, there is usually a Human Machine Interface at the top, where an operator can monitor or operate the system. This is typically linked to a middle layer of programmable logic controllers (PLC) via a non-time-critical communications system, such as an ethernet. At the bottom of the control chain a fieldbus links the PLCs to the components, such as sensors, actuators, electric motors, console lights, switches, valves and contactors, that actually perform the work. – See more at: http://www.fieldbusinc.com/downloads/fieldbus_comparison.pdf
AGA-12	Cryptographic protection of SCADA Communications	The American Gas Association (AGA) charged the AGA 12 Cryptography Working Group with developing a suite of open standards, designated AGA 12, to protect the data transmitted by SCADA systems, to authenticate the originators of messages on SCADA systems and to ensure data integrity. The fundamental goal of the AGA 12 group is to allow SCADA operators to specify good communication security without first delving into complicated topics, such as cryptography and digital certificates. By specifying AGA 12 compliance for SCADA equipment and following recommendations in the documents, pipelines and utilities are able to confidently protect their systems from cyber-attack. To ensure low-cost products through competition , AGA 12 requires SCADA cyber security equipment to interoperate independent of manufacturer or age.- See more at:

		http://www.thefreelibrary.com/AGA+12+recommends+how+to+protect+SCADA+communications+from+cyber...-a0155163814
API 1164	Pipeline SCADA Security	API 1164 addresses access control, communication security, information distribution classification, physical issues, including disaster recovery and business continuity plans, operating systems, network design, data interchange between enterprise and third-party support and customers, management systems, and field devices configuration and local access.
IEEE P1686	Substation Intelligent Electronic Devices (IED) Cyber Security Capabilities	The IEEE P1686 standard defines the functions and features that must be provided in intelligent electronic devices (IEDs) to accommodate critical infrastructure protection programs. The standard addresses security regarding the access, operation, configuration, firmware revision and data retrieval from an IED. Encryption of communications to and from the IED is also addressed.
IEEE P1689	Trial Use Standard for Cyber Security of Serial SCADA links and IED Remote Access	The Substation Committee of the IEEE Power Engineering Society is writing P1689 Trial Use Standard for Retrofit Cyber Security of Serial SCADA Links and IED Remote Access. The standard defines the requirements for a retrofit, or bump-in-the-line, device to protect serial communication " which they specified occurs in such a manner as to minimize the changes needed to existing equipment and software. P1689 lists general requirements and IEEE P1711 defines a specific serial security protocol for two types of cryptographic modules. SCADA Cryptographic Modules protect the serial SCADA channel. Maintenance Cryptographic Modules protect the maintenance channel, which is typically a dial-up connection. The P1689 retrofit devices operate in pairs with one unit at a substation or other field site and the other unit typically at a control center.
EEMUA PUBLICATION No 191	Alarm Systems (A Guide to Design, Management and Procurement)	Alarm systems form an essential part of the operator interfaces to large modern industrial facilities. They provide vital support to the operators by warning of situations that need attention and have an important role in preventing, controlling and mitigating the effects of abnormal situations. Since it was first published in 1999, EEMUA 191 has become the globally accepted and leading guide to good practice for all aspects of alarm systems. The guide, developed by users of alarm systems with input from the British Health and Safety Executive, gives comprehensive guidance on designing, managing and procuring an effective alarm system. The new Third Edition has been comprehensively updated and includes guidance on implementing the alarm management philosophy in practice, applications in geographically distributed processes and performance metrics and KPIs.
IEEE C37.1	Standard for SCADA and	The requirements for SCADA and automation systems in substations are defined in standard IEEE C37.1. This standard defines the process of substation integration as the design process that is the foundation for

	Automation Systems	substation automation. Functional and environmental requirements are provided for all IEDs located in the system. Tutorial material is included in the annexes to address common issues with systems without introducing requirements. Information is also presented in the annexes regarding SCADA masters. - See more at: http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4518928
API RP 1113	Developing a Pipeline Supervisory Control Center	Developing a Pipeline Supervisory Control Center supersedes the 3rd Edition of Publ 1113 and focuses on those design aspects that may be considered appropriate for developing or revamping a control center. Centralized monitoring and controlling of a pipeline system occurs in a pipeline supervisory control center. This document is not all-inclusive. It is intended to cover best practices and provide guidelines for developing a control center only. It does not dictate operational control philosophy or overall supervisory control and data acquisition system functionality. This document is intended to apply to control centers for liquids pipelines. However, many of the considerations may also apply to gas control center design.
API Q1 and Q2	Industry Quality Standard within the Oil & Gas Industry	API Q1 & API Monogram gives an externally checked confidence that a business is using a documented system and that products fulfil customer requirements and that the vendor is committed to improvement. It also provides assurance to customers that they can depend on consistent product quality. API Q2 provides equivalent confidence for services and product services. API Q1 and Q2 documentation available from API.
ANSI/RIA R15.06	Industrial Robots and Robot Systems- Safety Requirements	This standard provides guidelines for the manufacture and integration of Industrial Robots and Robot Systems with emphasis on their safe use, the importance of risk assessment and establishment of personnel safety. This standard is a national adoption of the International Standards ISO 10218-1 and ISO 10218-2 for Industrial Robots and Robot Systems, and offers a global safety standard for the manufacture and integration of such systems.- See more at: http://www.robotics.org/Robot-Safety-Standard
IEEE 1490-2011	IEEE Guide--Adoption of the Project Management Institute (PMI(R)) Standard	This standard is a guide to the Project Management Body of Knowledge (PMBOK(R) Guide). It definesverification and validation, which can be applied to sensors and systems as follows in its 4th edition. The guide defines verification as the evaluation of whether a product, service or system complies with a regulation, requirement, specification or imposed condition. It is often an internal process. Contrast with validation. It defines validation as the assurance that a product, service or system meets the needs of the customer and other identified stakeholders. It often involves acceptance and suitability with external customers. S EBoK Guide to the Systems Engineering Body of Knowledge, System Verification Section, https://www.sebokwiki.org/wiki/System_Verification

Appendix II - Communications Protocols

Foundation Fieldbus H1		FOUNDATION H1 is a bi-directional protocol used for communications among field devices and to the control system. It utilizes twisted pair or fiber media to communicate between multiple nodes (devices) and the controller. The controller requires only one communication point to communicate with up to 32 nodes; this is a significant improvement over the standard 4-20mA communication method, which requires a separate communication point for each communication device on the controller system.
Foundation Fieldbus HSE		High Speed Ethernet (HSE) is ideally suited for use as a control backbone. Running at 100 Mbit/s, the technology is designed for device, subsystem and enterprise integration. It supports the entire range of fieldbus capabilities, including standard function blocks and Device Descriptions , as well as application-specific Flexible Function Blocks for advanced process and discrete/hybrid/batch applications.
Profibus		The history of PROFIBUS goes back to a publicly promoted plan for an association founded in Germany in 1986 and for which 21 companies and institutes devised a master project plan called "fieldbus." The goal was to implement and spread the use of a bit-serial field bus based on the basic requirements of the field device interfaces. For this purpose, member companies agreed to support a common technical concept for production (i.e. discrete or factory automation) and process automation. First, the complex communication protocol Profibus FMS (Field bus Message Specification), which was tailored for demanding communication tasks, was specified. Subsequently in 1993, the specification for the simpler and thus considerably faster protocol PROFIBUS DP (Decentralized Peripherals) was completed. Profibus FMS is used for (non deterministic) communication of data between Profibus Masters. Profibus DP is a protocol made for (deterministic) communication between Profibus masters and their remote I/O slaves. Two variations of PROFIBUS are in use today. PROFIBUS DP (Decentralized Peripherals) is used to operate sensors and actuators via a centralized controller in production (factory) automation applications. This version focuses on the many standard diagnostic options. PROFIBUS PA (Process Automation) is used to monitor measuring equipment via a process control system in process automation applications. This variant is designed for use in explosion/hazardous areas (Ex-zone 0 and 1). The Physical Layer (i.e. the cable) conforms to IEC 61158-2, which allows power to be delivered over the bus to field instruments, while limiting current flows so that explosive conditions are not created, even if a malfunction occurs. The number of devices attached to a PA

		segment is limited by this feature. PA has a data transmission rate of 31.25 kbit/s. However, PA uses the same protocol as DP, and can be linked to a DP network using a coupler device. The much faster DP acts as a backbone network for transmitting process signals to the controller. This means that DP and PA can work tightly together, especially in hybrid applications where process and factory automation networks operate side by side.
ProfiNet		PROFINET is a standard for industrial automation using a computer network. PROFINET uses standards such as TCP/IP and Ethernet. PROFINET's modular structure allows users to select only needed functions for different requirements.
Modbus		Modbus is a serial communications protocol originally published in 1979 by Modicon (now Schneider Electric) for use with its programmable logic controllers . Simple and robust, it has become a de facto standard communication protocol and is now a commonly available means of connecting industrial electronic devices. The main reasons for the use of Modbus in the industrial environment are: that it wasdeveloped with industrial applications in mind,is openly published and royalty-free, is easy to deploy and maintain and moves raw bits or words without placing many restrictions on vendors. Modbus enables communication among approximately 240 devices connected to the same network. Such a system may, for example, measure temperature and humidity and communicate the results to a computer. Modbus is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems. Many of the data types are named from its use in driving relays: a single-bit physical output is called a coil, and a single-bit physical input is called a discrete input or a contact. The development and update of Modbus protocols has been managed by the Modbus Organization since April 2004, when Schneider Electric transferred rights to that organization. The Modbus Organization is an association of users and suppliers of Modbus compliant devices that seeks to drive the adoption and evolution of Modbus.
HART	Highway Addressable Remote Transducer Protocol	The HART Communications Protocol (Highway Addressable Remote Transducer Protocol) is an early implementation of Fieldbus, a digital industrial automation protocol. Its most notable advantage is that it can communicate over legacy 4-20 mA analog instrumentation wiring, sharing the pair of wires used by the older system. According to Emerson, due to the huge installed base of 4-20 mA systems throughout the world, the HART Protocol is one of the most popular industrial protocols today. HART protocol has made a good transition protocol for users who were comfortable using the legacy 4-20 mA signals but wanted to implement a "smart" protocol. Industries seem to be using

		Profibus DP/PA and Foundation fieldbus (also by Rosemount) more as users become familiar with later technology and look to take advantage of the enhanced diagnostics they can provide. The protocol was developed by Rosemount Inc., built off the Bell 202 early communications standard, in the mid-1980s as proprietary digital communication protocol for their smart field instruments. Soon it evolved into HART. In 1986, it was made an open protocol. Since then, the capabilities of the protocol have been enhanced by successive revisions to the specification.
OPC	Object Linking and Embedding (OLE) for Process Control	Object Linking and Embedding for Process Control (OPC), is the original name for a standards specification developed in 1996 by an industrial automation industry task force. The standard specifies the communication of real-time plant data between control devices from different manufacturers. OPC has also grown beyond its original OLE implementation to include other data transportation technologies including XML, Microsoft's .NET Framework, and even the OPC Foundation's binary-encoded TCP format. After the initial release in 1996, the OPC Foundation was created to maintain the standard. Since then, standards have been added and names have been changed. As of June 2006, "OPC is a series of standards specifications". (Seven current standards and two emerging standards.) "The first standard (originally called simply the OPC Specification"), is "now called the Data Access Specification", or (later on the same page) "OPC Data Access", or OPC Data Access Specification.
WITS and WITSML	Wellsite information transfer standard markup language	Wellsite information transfer standard markup language (WITSML) is a standard for transmitting technical data between organizations in the petroleum industry. It continues to be developed by an Energistics facilitated Special Interest Group to develop XML standards for drilling, completions, and interventions data exchange. Organizations for which WITSML is targeted include energy companies, service companies, drilling contractors, application vendors and regulatory agencies.
ETP	Energistics Transfer Protocol	ETP is an advanced data exchange specification that enables the efficient transfer of data between applications and systems. http://www.petrolink.com/etp/
DDS	Data Distribution Service	Developed for military applications and published by the Object Management Group, the DDS specification describes two levels of interfaces. The first is a lower data-centric publish-subscribe level that is targeted towards the efficient delivery of the proper information to the proper recipients. The other is anoptional higher data local reconstruction layer , which allows for a simple integration of DDS into the application layer.

12 of 14: Industry Standards and Certification