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Utility Deregulation Requires Effective E-Business Standards

By Alan Kotok

THE FOREMOST STANDARDS COMMUNITY FOR E-BUSINESS

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Executive summary

The gas and electric power utilities industries in North America have demonstrated the important role that standards can play in business, and both industries have used those standards to provide a level of service and stability that are critical to the day-to-day life of every family and business. Over the past quarter century, worldwide conditions in the energy markets and a global privatization trend have encouraged authorities to reduce the amount of regulation over the utilities industries. This white paper analyzes business practices in the industry resulting from deregulation, including the current use of e-business, and offers recommendations for e-business standards to support the goals of deregulation.

The utilities industries in the U.S. and Canada have a responsibility to reliably deliver electric power and natural gas to customers at stable prices. The industries divide their efforts by fuel type – electrical power and natural gas. They also are divided by wholesale and retail levels, with each of the four quadrants comprising a major industry sector. In the utilities industries, the wholesale level covers trade from initial production or generation to the local utilities distributors; e.g. Consolidated Edison, Pacific Gas and Electric. Retail trade covers activities from the local distributor to the end-consumers, which can be industrial companies, commercial businesses, or private residences. While the vast majority of retail customers are private residences, the industrial and commercial customers (also considered retail customers) consume the most energy.

With deregulation the industries have restructured to allow for more competition at all levels, while maintaining limited regulation to ensure fulfillment of basic services and maintain competition. At the national level in the United States, the Federal Energy Regulatory Commission (FERC) monitors wholesale gas and electric trade. Individual state public utility commissions regulate the retail transactions. At this time, less than half of the 50 states provide for consumer choice in utilities for homes and small businesses, although most of the larger industrial and commercial customers have had that option for some time.

With deregulation, utilities companies have unbundled their previously integrated services, which has led to mergers and brought new companies into the business. With the unbundled services, new companies in the marketplace, and new kinds of services being offered to customers, the industry has become much more dynamic, with new business processes emerging. Many of those new processes rely on electronic exchanges of data between companies to conduct basic business functions, as well as keep the supplies of energy flowing reliably and securely. However, recent events have also shown an urgent need for transparency, traceability, and auditibility in industry transactions.

The utilities industries have relied on voluntary industry standards in some form since the 1960s, but since the trend in deregulation has accelerated, voluntary standards have taken on more importance. For e-business transactions, many companies in the industry successfully use EDI transactions, especially in the wholesale gas and retail electric quadrants. The Petroleum Industry Data Exchange, Gas Industry Standards Board (now North American Energy Standards Board), and Utilities Industry Group have all written implementation guidelines for EDI. With deregulation, and the introduction of trading in energy supplies and futures, as well as electronic marketplaces, the use of XML and Web-based transactions has increased, particularly for companies that had not yet implemented EDI.

The paper outlines a high-level strategy for e-business in this more dynamic environment, yet that still recognizes the continuing need for reliability, a heightened need for security, and recent calls for more transparency. The utilities industries should consider developing common business processes, independent of technology and cutting across the traditional boundaries, to provide a roadmap for the development and integration of e-business transactions. Parts of the utilities industries already have experience with this approach to business processes. The paper recommends continuing the use of EDI for high-volume and direct transactions with stable content, while planning for increased use of XML (including ebXML and Web services) where conditions call for more flexibility or intermediaries. The industries should also consider adapting XML practices and vocabularies from the financial services and retail industries that can short cut the development process as well as provide more transparency in electronic transactions.

1. Introduction

1.1   Status of this document

This document is a white paper for discussion in the general e-business community and utilities industries. Its distribution is unlimited. Style and formatting follow the Data Interchange Standards Association (DISA) publication guidelines.

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2. Business issues in utility deregulation

2.1 The utility industries are large, diverse, and critical to the success of the economy

The electric and gas utilities are perhaps two of the most basic industries to the well being of a society and economy. Because just about every company and family depends on electricity and natural gas -- they literally power our businesses and heat our homes -- public authorities and private companies have devised a long-standing collaborative system called public utilities to ensure their constant flow. And as important as the continuous flow of electricity and gas is the need for stable or at least predictable prices for these commodities. As a result, the system of public utilities for many years regulated the prices charged consumers, balancing the energy companies' income against the customers' need for affordability and stability.

Because utilities are basic factors in a society or economy, they have an enormous scale, serving hundreds of millions of customers in the United States. The vast majority of these utility customers are private homes; see Figure 1. In 1999, electric utilities had over 125 million American customers, of which nearly nine in 10 (87%) were residential customers. Another 11 percent were commercial establishments (e.g. retail stores and office buildings), while less than 0.5 percent were industrial customers such as factories.[1] Natural gas had 61.8 million U.S. customers in 1999 of which more than nine in 10 were residential customers, representing 61 percent of American homes. Some 7.7 percent of U.S. natural gas customers were commercial establishments, while less than 0.3 percent were manufacturing plants.[2]

The patterns of consumption, however, differ markedly from the numbers of consumers. While individual homes are far and away the most numerous consumers of electricity and gas, residences consume only about a third of the electricity[3] and about a quarter of the gas[4] delivered to customers; see figure 2. Commercial users consume about another third of the electricity, and industrial customers consume just under a third (about 29%).[5] Industrial customers represent the largest users of natural gas, consuming just under half (46%) of the gas delivered to consumers, while commercial customers used about 15 percent of the gas deliveries in 2000.[6]

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[1] "Electricity Quick Facts," U.S. Energy Information Administration, 25 February 2002, http://www.eia.doe.gov/neic/quickfacts/quickelectric.htm .

[2] "American Gas Association Updates Gas Facts," American Gas Association, press release of 28 February 2001.

[3] "U.S. Electric Power Industry Summary Statistics," U.S. Energy Information Administration, 25 April 2002, http://www.eia.doe.gov/cneaf/electricity/epm/epmt02p1.html .

[4] "Summary Statistics for Natural Gas in the United States, 1996-2000," Natural Gas Annual, U.S. Energy Information Administration, page 6. http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_annual/current/pdf/table_001.pdf

[5] "U.S. Electric Power Industry Summary Statistics," U.S. Energy Information Administration, 25 April 2002, http://www.eia.doe.gov/cneaf/electricity/epm/epmt02p1.html .
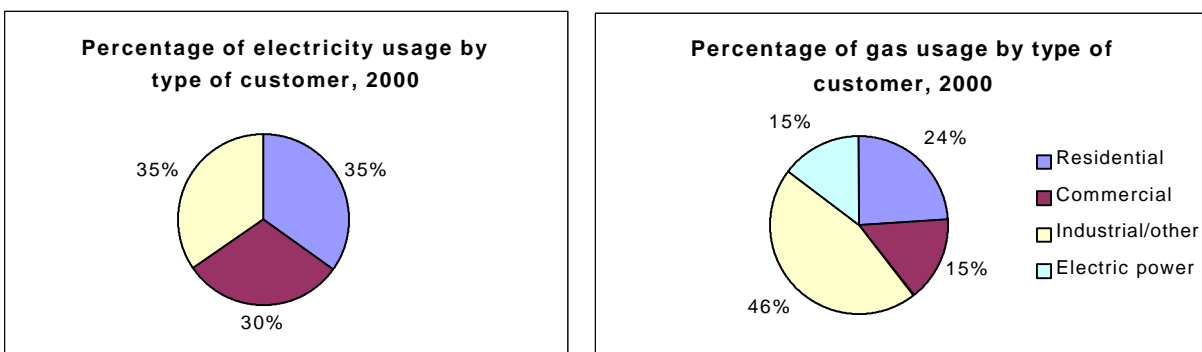
[6] "Summary Statistics for Natural Gas in the United States, 1996-2000," Natural Gas Annual, U.S. Energy Information Administration, page 6. http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_annual/current/pdf/table_001.pdf

Figure 1. The vast majority of utility customers are residences …

Electric utility customers, 1999

11%   1%

88%

Gas utility customers, 1999

8% 0%

92%

☐ Residential
☐ Commercial
☐ Industrial/other
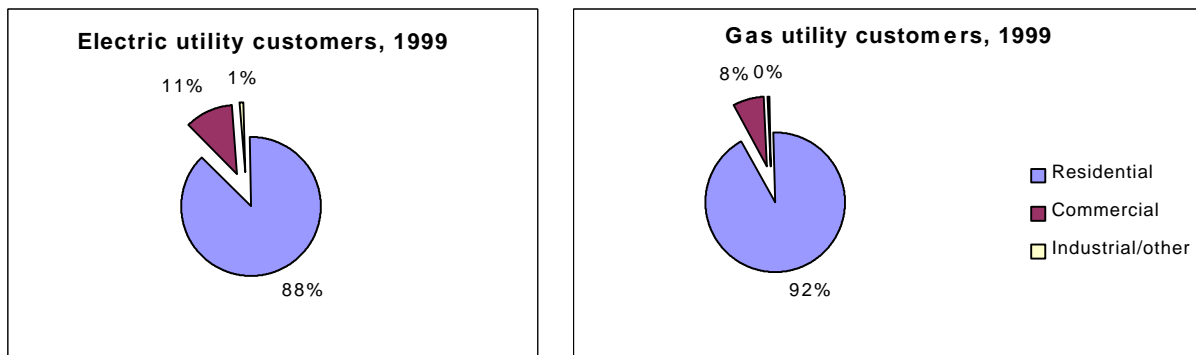
Sources: U.S. Energy Information Administration, American Gas Association

Figure 2. But most of the energy is consumed by industrial and commercial customers

Percentage of electricity usage by type of customer, 2000

35%   35%

30%

Percentage of gas usage by type of customer, 2000

15%   24%

46%   15%

☐ Residential
☐ Commercial
☐ Industrial/other
☐ Electric power

Source: U.S. Energy Information Administration

Moreover, the markets for electricity and gas overlap to some extent. A major sector of gas customers is electric power generation plants. In 2000, about 16 percent of the total net electrical power generated in the United States came from natural gas.[7]

The utility industries also make a distinction between wholesale and retail trade. Wholesale utility markets represent trade between producers or generators of the power and intermediaries, such as pipelines, storage facilities, transmission grids, and local distribution companies. Retail trade generally covers interactions between the local distribution companies and consumers. The terms 'wholesale' and 'retail' can be a little misleading, however. Remember that industrial and commercial customers, while far fewer in number than residences, are the large bulk consumers of gas and electricity but still considered part of the retail market. Thus, the terms represent supply-chain relationships and not pricing policies.

With deregulation and advances in technology have come new participants in the U.S. utilities marketplace. The traditional electrical utilities include privately-owned companies, cooperatives like those often found in rural areas, and government-owned (usually local or state level) utilities. Added to the traditional utilities are smaller and independent power producers, as well as co-generators of electricity, usually manufacturers in other lines of business that generate electricity as a by-product of their industrial

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[7] "Electric Power Annual, 2000," U.S. Energy Information Administration, August 2001, http://www.eia.doe.gov/cneaf/electricity/epav1/generation.html .

processes. In 1999, these non-utility producers accounted for 15 percent of the total electricity generated in the United States.

Natural gas used in the United States comes primarily from production wells in North America, with modest amounts of liquefied natural gas imported from overseas.[8] Once out of the wells, processing plants remove impurities and a network of underground pipelines and compressor stations transport the gas to local communities. Local distribution companies store and deliver the gas to consumers. Many of the storage facilities hold gas during off-peak periods for delivery during high-usage times, such as colder winter days.[9]

Power marketers are another player, and one becoming more important, in the electrical power marketplace. Power marketers are independent intermediaries that buy wholesale electrical power and trade it as a commodity. Related to the marketers are merchant generators that both own production capacity and trade in the commodity. The amount of electrical power traded by marketers and merchants has jumped from 27 million megawatt hours (MWh) in 1995 to 1.2 billion MWh in 1999.[10]

2.2   Deregulation creates new business dynamics

While stability and predictability may have been desirable conditions of the public utility system, investment and competitive pressures have forced the utilities to adjust to new realities. The system of public utilities consisted of private companies (sometimes public-owned organizations) given an exclusive franchise over a specified geographic area, but regulated by the states' public services commissions. This system sought to provide reliable energy to homes and businesses at reasonable prices, while at the same time providing the utility company a fair return.

Events during the last part of the 20th century challenged the assumptions of public utility model and set in motion changes that the American economy still feels today. Sharp fluctuations in oil prices in the 1970s and concerns about supplies resulted in new legislation encouraging more competition in the energy industries and eventually more reliance on the marketplace rather than monopolies and regulators to provide the desired stability and reliability. In 1978, Congress passed the Public Utility Regulatory Policy Act of 1978 that introduced some competition in the electrical power industry, and enabled power co-generation and independent power producers. The Energy Policy Act of 1992 continued this process and permitted a new class of deregulated power generation companies, called exempt wholesale generators, that demonstrated the economic benefits of deregulation.[11]

Congress saw the need for continued regulation of nationwide energy policies and practices, and in 1977 established the Federal Energy Regulatory Commission or FERC. This agency, under the Department of Energy, regulates the interstate transmission and sale of natural gas, and the transmission and wholesale trade of electricity. FERC licenses and inspects hydroelectric projects and oversees environmental

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[8] "The Supply Challenge," Fueling the Future: Natural Gas & New Technology for a Cleaner 21st Century, American Gas Association, 2000, http://www.fuelingthefuture.org/contents/MeetingtheChallenge.asp .

[9] "Delivery System," Fueling the Future: Natural Gas & New Technology for a Cleaner 21st Century, American Gas Association, 2000,
http://www.fuelingthefuture.org/contents/ExpandingNaturalGasDelivery.asp .

[10] "Electric Power -- An Overview Of The Industry and Its Impact," Edison Electrical Institute, pp. 6-7

[11] "National Guidelines For Restructuring The Electric Generation, Transmission and Distribution Industries," National Energy Marketers Association, pp. 2-3.

matters relating to energy production. FERC recovers all of its costs from the industries it regulates through fees and annual charges.[12]

Over the past several years, FERC has encouraged the deregulation of wholesale utility markets through a number of key rules. In 1992, FERC order 636 requiring gas pipelines to unbundle their services, to introduce more competition for these services into the marketplace. The order enabled pipelines to offer a range of different pricing options, as well as unbundled sales, storage, quality, and transportation services.[13]

In 1996, FERC issued two related orders opening wholesale electricity sales to competition. Order 888 requires public utilities that own or operate transmission lines to file open access tariffs (prices), which means they must offer same prices and services for transmitting electrical power that they offer to themselves. Rule 888 also allows for the recovery of stranded costs, i.e., those incurred by transmission providers to serve power customers, but would not be recovered if the customer moved to another supplier. This order, in effect, opened transmission lines to multiple power suppliers.[14]

At the same time FERC issued a companion order, number 889, that focuses particularly on information services. This order requires utilities that own or operate transmission facilities to provide open access to information about available transmission capacity, prices, and other kinds of information to enable customers to obtain open and equivalent transmission services. The rule requires utilities in the transmission business to create or take part in an Open Access Same-time Information System or OASIS that provides this information over electronic networks. The order also spells out standards of conduct to prevent utilities with transmission facilities from having an unfair advantage of other power producers using those facilities.[15]

In December 1999, FERC issued order 2000 encouraging power utilities that own transmission facilities to create regional transmission organizations or RTOs that provide distribution of power at the wholesale level. The RTOs, according to the order, will use market mechanisms manage the flow of power through its facilities and administer their own tariffs or pricing. The RTOs must monitor the operation of their markets to spot any design flaws and propose actions to fix the problems. The RTOs also need to address parallel flow issues within and outside their regions, plan any transmission enhancements or additions, and serve, if needed, as the supplier of last resort. RTOs, as well, must administer an OASIS system as spelled out in order 889. The final rule added coordination between regions as a function of the RTOs.[16]

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[12] "About FERC," Federal Energy Regulatory Commission, 23 January 2002, http://www.ferc.gov/about/about.htm .

[13] "Restructuring of Pipeline Services," Federal Energy Regulatory Commission, 15 January 2002, http://www.ferc.gov/news/rules/pages/order636.htm .

[14] "Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities," Federal Energy Regulatory Commission , 24 April 1996, Order No. 888, http://www.ferc.fed.us/news/rules/data/rm95-8-00V.txt .

[15] "Open Access Same-Time Information System (formerly Real-Time Information Networks) and Standards of Conduct," Federal Energy Regulatory Commission, 24 April 1996, Order No. 889, http://www.ferc.fed.us/news/rules/data/rm95-9-00k.txt

[16] Amy Abel, "Transmission Issues," Electric Utility Restructuring Briefing Book, Congressional Research Service, 19 October 2000, http://www.cnie.org/nle/crsreports/briefingbooks/electricity/ebeleti.cfm . For the full text of the order, see http://www.ferc.gov/news/rules/pages/RM99-2A.pdf.

Deregulation is also occurring at the state level, where the actions of the electric and gas utilities have been regulated over the years by agencies often known as public utility or public service commissions. However, progress on deregulation has been uneven. As of March 2002, the Energy Information Administration lists 17 states and the District of Columbia (D.C.), mainly in the Northeast and Middle Atlantic states plus Texas and Arizona, as having active electrical power restructuring programs. Seven other states (West Virginia, Arkansas, Oklahoma, New Mexico, Nevada, Oregon, and Montana) had delayed their restructuring, and one state – California – suspended its program.[17]

For natural gas, the Energy Information Administration says 20 states and D.C. have programs underway that allow residential and low-volume commercial or industrial users to purchase gas from suppliers other than the traditional utility company. Five states (New Jersey, New Mexico, New York, Pennsylvania, and West Virginia) plus D.C. allow all of their customers to take part in these citizen choice programs. Nine other states are still in the implementation phase or are still phasing customer-choice. Some 18 states have taken no action on deregulation, while two states (Delaware and Wisconsin) have discontinued their pilot programs.[18]

While this paper focuses on utility deregulation in North America, deregulation is also underway elsewhere in the world. In the late 1990s, the European Union issued directives to liberalize markets in gas (1998) and electricity (1999). The 1998 natural gas directive aims to create competitive markets by developing common rules for transmission, distribution, supply, and storage. The order also requires opening the gas distribution network to third parties.

The directive does not impose deregulation on member EU states, but lets the states choose between regulated and negotiated access by third parties to distribution facilities. Regulated access means letting third parties access the facilities according to published tariffs. Negotiated access, as the name implies, allows eligible customers bargain over rates and supplies, but requires gas utilities to publish their conditions for commercial use of the facilities.[19]

Like its natural gas counterpart, the EU's electrical power directive aimed at opening the market for this utility. The directive separates regulatory from operational functions, and required opening by the year 2000 about a quarter of the electrical power markets in each EU country. [20]

In Asia, deregulation and privatization has had more of a mixed record. An important consideration in many of the privatization plans is the need for investment capital, and the preference among global investors for privately owned, as opposed to public sector or closely regulated organizations. Despite many highly publicized plans for privatization, there are still only a few real projects underway.[21]

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[17] "Status of State Electric Industry Restructuring Activity," Energy Information Administration, 9 May 2002, http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html .

[18] "Retail Unbundling - U.S. Summary," Energy Information Administration, 4 April 2002, http://www.eia.doe.gov/oil_gas/natural_gas/restructure/state/us.html

[19] "European deregulation," Platts Global Energy, 2001, http://www.platts.com/dereg/europe.shtml

[20] "European deregulation," Platts Global Energy, 2001, http://www.platts.com/dereg/europe.shtml

[21] "Deregulation in Asia," Platts Global Energy, 2001, http://www.platts.com/dereg/europe.shtml

2.3   Security continues to be a major concern of the utilities industries

Because of their importance to the functioning of a society, utilities have traditionally put a premium on security. The events of September 2001 only added to the urgency of protecting the valuable assets for production and distribution of energy, since they make inviting targets for terrorists. In May 1998, Presidential Decision Directive NSC/63 identified the potential threat of terrorism to U.S. physical and information-technology systems in both the public and private sectors that are vital to the operation of the economy and the government. The directive identified these systems to include …

> telecommunications, energy, banking and finance, transportation, water systems and emergency services, both governmental and private. Many of the nation's critical infrastructures have historically been physically and logically separate systems that had little interdependence. As a result of advances in information technology and the necessity of improved efficiency, however, these infrastructures have become increasingly automated and interlinked. These same advances have created new vulnerabilities to equipment failure, human error, weather and other natural causes, and physical and cyber attacks.

The directive also noted …

> Because of our military strength, future enemies, whether nations, groups or individuals, may seek to harm us in non-traditional ways including attacks within the United States. Because our economy is increasingly reliant upon interdependent and cyber-supported infrastructures, non-traditional attacks on our infrastructure and information systems may be capable of significantly harming both our military power and our economy. [22]

The directive encouraged the owners of these assets in the private sector to provide the maximum security feasible and to share information with the government as part of the overall effort. The document also recommended that participation by the private sector be voluntary, to fully engage its cooperation.

In the aftermath of 11 September 2001, a report from the National Regulatory Research Institute (NRRI) highlighted the threats of physical and cyber-attacks on utilities. The NRRI noted that the exposed nature of many electric and gas utility assets required heightened vigilance. On the topic of information security, the report said, "Both natural gas and electric networks are subject to cyber-attacks. But because electricity is simultaneously generated as it is consumed, the electric network is particularly vulnerable to cyber-attacks that could create imbalance between supply and demand, which could lead to brown-outs or voltage surges."[23]

Yet at the same time that the nation and industry have raised the bar on security for utilities' physical assets and information systems, the utilities are decentralizing, unbundling their services, and adding more trading partners to the mix. In the traditional public utility model, electrical energy companies deployed centrally managed supervisory control and data acquisition (SCADA) systems to monitor the total generation and distribution network. The typical SCADA system has some 30,000 to 50,000 data collection points. The first SCADA systems were built separate from the corporate administrative systems and closed off to remote access.

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[22] "Presidential Decision Directive NSC/63," 22 May 1998, archived by the Federation of American Scientists, http://www.fas.org/irp/offdocs/pdd/pdd-63.htm

[23] Robert Burns, Frank Darr, John Wilhelm and Vivian Witkind Davis, "National Security And State Public Utility Commissions," National Regulatory Research Institute, 20 September 2001, http://www.nrri.ohio-state.edu/whatsnew/pdf/securitymemo.pdf

With deregulation, however, utility companies have started dealing with new entities, such as power marketers and electronic marketplaces, or have spun off their merchant generator subsidiaries. The companies have also installed new systems that increase the interactions with customers or suppliers. Many of these systems use the Internet as the transport medium. And with deregulation, the SCADA systems, previously kept separate from the companies' central business systems, are now being integrated into the rest of the overall corporate architectures. While the integration of these systems can make good business sense, they also lower the security threshold and increase the potential risks to the overall networks.[24]

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[24] Joe Pendry, "Information Security Challenges In The Electric Power Industry," Riptech Inc., January 2001, pp. 2-5, http://www.riptech.com/pdfs/information_0101.pdf

3. Electronic business offers new opportunities for deregulated utilities and their trading partners

3.1   Deregulation creates new business processes for utilities

Deregulation, almost by definition, means the creation of new or highly modified business processes in the utility industries. Since the goal of restructuring the industries is to use market forces to increase supplies and improve service to customers, utility companies need to be prepared to deal with new trading partners, as well as relate to their existing business contacts in different ways.

3.1.1.   Wholesale natural gas

According the U.S. Energy Information Administration (EIA), the natural gas industry has had some success in negotiating these new challenges. Gas, unlike electricity, is often produced long distances from the end-consumers, thus requiring a complex network of distribution and storage facilities. But while traditional gas markets worked with predetermined and dedicated products, the new deregulated market requires the ability to make changes in supplies and quantities on short notice. This need is particularly acute during the winter, when quick temperature changes can rapidly alter consumption patterns.

The gas industry responded with increased storage and improved monitoring and management of pipelines, as well as more pooling points and exchange facilities. While in earlier years, these services were provided by integrated companies (and could be arranged informally), with deregulation these services now are provided by independent entities that require documented business-to-business agreements and interactions.

Deregulation also brought the independent wholesale marketer to greater prominence in the gas industry. EIA cites an industry directory that shows the number of independent marketers increasing from 51 to 1986, to 353 in 1994, although the number dripped to 264 in 1996 due to consolidation. The use of commodity futures markets in natural gas has grown in tandem with the number of independent gas marketers.   These more complex financial instruments have helped provide more liquidity and risk management, but they also require more complex information systems to manage.[25]

3.1.2   Wholesale electricity

The deregulation movement has had a marked effect on the way business is conducted between the producers of electrical power and the facilities that distribute the power throughout the regions. Electricity, unlike gas, moves at the speed of light and cannot be stored in large quantities. Electrical power flows wherever a path exists, and is not easily redirected.   This same idea also means a dislocation anywhere in the distribution network can affect other points on the network. Thus, the distribution of electrical power requires close coordination and monitoring.

To provide the close coordination needed to manage the flow of electrical power, the industry created 10 regional reliability councils, which oversee the operation of three power grids in the lower 48 United States and Canadian provinces. The Eastern and Western grids divide roughly at the Rocky Mountains, while Texas has its own power grid.[26]

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[25] Margaret Jess, "Restructuring Energy Industries: Lessons from Natural Gas," Natural Gas Monthly, May 1997.
ftp://ftp.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/1997/restructuring_energy_industries_lessons/pdf/peg.pdf

[26] "Electricity Transmission Fact Sheet," U.S. Energy Information Administration, 28 March 2002, http://www.eia.doe.gov/cneaf/electricity/page/fact_sheets/transmission.html

The grids are made up of a series of high capacity transmission lines that link generating capacity to centers of demand. The grid operators (the reliability councils) closely monitor the generation and consumption of power to keep the system in balance, and to coordinate the flow of power through the grid. Utilities use computer models to test generation and transmission capacity in the event of peak loads, such as on excessively hot days, or emergencies, such as lightening strikes or ice storms. Power utilities also must keep reserve margins beyond anticipated demands.[27]

The regional reliability councils have formed a North American Electric Reliability Council or NERC that establishes common operating policies and business standards for managing bulk electrical transmissions. Formed after a damaging 1965 blackout in the Northeast U.S. and adjoining Canadian provinces, NERC has become a key player in creating the business practices needed to support deregulation. NERC's services include databases for estimating supply and demand for power as well as analyzing disturbances over the bulk electrical systems.[28]

While demand for electrical power has steadily increased, new generating and transmission capacity has not kept pace with the demand. While natural gas can be transported underground from remote wells, electricity requires large generating plants, often in close proximity to the users. Also, electric power needs transmission as well as generation capacity. To get new electric power to users requires right-of-ways for highly visible and obtrusive transmission lines plus transformers to step-down the voltage for residential and business consumers. The difficulty in siting and building these physical facilities has put an increasing burden on the reliability organizations to manage the grids.[29]

To help cope with the changing wholesale market for electricity, FERC issued for comment in March 2002 a proposed standardized transmission service and design for wholesale markets. The proposal seeks to create a single set of rules for the transmission of electrical energy. As the paper notes,

> The electrons moving across the grid do not distinguish between bundled retail and other services, and behave according to the laws of physics rather than the laws of a particular jurisdiction. With more non-integrated electricity suppliers and a deeper reliance on wholesale electric markets, there are substantial competitive consequences and higher costs to all retail customers if we do not apply consistent, non-discriminatory rules to all transmission customers.[30]

The paper notes that the lack of common business practices creates supply dislocations, misunderstanding of market conditions, and inequitable pricing. Among the problems noted in the paper are differences in software platforms between regions that impede trade between those regions.[31]

The paper establishes rules for day-ahead and real-time trading in wholesale electricity, using a voluntary bidding system, constrained by the required safety margins of the operators. The objective is to use real-

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[27] "Electric Transmission Systems: Making the Vital Link to Consumers," Edison Electric Institute, June 2001, http://www.eei.org/future/reliability/c_layout.pdf

[28] "About NERC," North American Reliability Council, 2002, http://www.nerc.com/about/

[29] "Electricity Transmission Fact Sheet," U.S. Energy Information Administration, 28 March 2002, http://www.eia.doe.gov/cneaf/electricity/page/fact_sheets/transmission.html

[30] "Working Paper on Standardized Transmission Service and Wholesale Electric Market Design," Federal Energy Regulatory Commission, 15 March 2002, page 2, http://www.ferc.gov/Electric/RTO/mrkt-strct-comments/e-1finalSMD.PDF

[31] "Working Paper on Standardized Transmission Service and Wholesale Electric Market Design," page 3.

time trading as a form of market of last resort to correct imbalances arising from long-term contracts and day-ahead markets.[32]

The proposal calls for market monitoring units (MMUs) funded by the regional transmission organizations but operating independently. The MMUs would monitor the operation of the markets to uncover structural design flaws, but also to spot market or price manipulations.[33]

One of the newer players in the wholesale electricity marketplace is the energy marketer. As noted above in section 2.1, the amount of electrical power traded by the energy marketer has increased significantly in the past several years. EIA reports that FERC classifies over 500 companies as electrical power marketers and have file tariffs with FERC. However, most of the actual sales by marketers are concentrated in 50 companies or less.[34]

Related to the energy marketer is the electronic marketplace that acts as an online facilitator between energy buyers and sellers. While several online exchanges devoted to energy marketing have been established, the mixed and unsettled regulatory environment in the United States has slowed their development. The wholesale electronic exchanges often resemble commodity markets, and trade in more exotic products such as derivatives, and allowances for pollutants/emissions (e.g., CO_2, SO_2). Examples are DynegyDirect, TradeSpark, and Intercontinental Exchange.[35]

Europe has one of the more successful electronic exchanges for wholesale power marketing. Nord Pool, which began in 1993, serves the Scandinavian countries and in 2001 the volume traded through Nord Pool for physical delivery represented 29 percent of the total electricity consumed in the Nordic countries. However, Nord Pool was created for a market with many players and has the backing of the national governments.[36] A Forrester Research study released in April 2001 predicted online energy trading would exceed $3.6 trillion by 2005, from $400 billion in the year 2000.[37]

Within a year of that report, however, the bright future predicted for independent traders and online exchanges dimmed considerably, as charges about market manipulation by Enron and other independent marketers surfaced. Stock prices for energy trading companies fell sharply, as the reports shook the confidence of financial markets in these companies.[38] According to Platts Global Energy, FERC Commissioner William Massey, in a public meeting on 15 May 2002 said the kind of practices reported in

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[32] "Working Paper on Standardized Transmission Service and Wholesale Electric Market Design," pp. 13, 17.

[33] "Working Paper on Standardized Transmission Service and Wholesale Electric Market Design," pp. 22-24.

[34] "Wholesale Competition in the U.S. Electric Power Industry Fact Sheet," U.S. Energy Information Administration, 28 March 2002, http://www.eia.doe.gov/cneaf/electricity/page/fact_sheets/wholesale.html

[35] Jon T. Brock, "Energy Trading: Another way to classify on-line electricity exchanges," Global Energy Business, November/December 2001, http://www.platts.com/business/issues/0111/0111geb_etradebrock.shtml

[36] "E-commerce in the power industry," Platts Global Energy, 2001, http://www.platts.com/features/ecommerce2001/power.shtml

[37] "Online Energy Trading Will Exceed $3.6 Trillion By 2005, According To Forrester Research," 10 April 2001, http://www.forrester.com/ER/Press/Release/0,1769,541,00.html

[38] Mitchell Benson, et al., "New Questions Over Energy Markets," The Wall Street Journal (WSJ.Com), 13 May 2002, http://www.msnbc.com/news/751431.asp

the media would erode public confidence in and political support for deregulated markets, and instructed energy trading companies to "stop the funny business and behave responsibly."[39]

In May 2002, the National Energy Marketers Association, in response to the concerns generated by these disclosures, announced it would develop national business practice standards, dealing with the management of credit and market risks, disclosure and reporting requirements, auditing, and compliance.[40]

Deregulation in electricity markets has meant not only the addition of new players, such as energy marketers and electronic exchanges, but also new companies getting into the market, and mergers of traditional utilities. EIA reports that as of the end of the year 2000, about 16 percent of the U.S. electrical generation capacity had been sold to unregulated companies or transferred to unregulated subsidiaries that sell their power in more competitive markets. Also, since 1995, FERC has approved some 50 mergers between investor owned utilities, and the trend is expected to continue.[41]

3.1.3   Retail gas and electricity

The ultimate consumers of the energy companies are the retail customers of the utilities, and it is the local companies that have traditionally provided the delivery, metering, billing, and customer service functions to the end-users. With competition, customers can choose among competing companies for the metering, billing, and customer service functions. Deregulation of trade between utilities and consumers (including high-volume industrial and commercial customers) generally has taken place at the state level, and as noted earlier, covers about half of the states and in various stages of progress.

Deregulation introduces new parties at the retail level, as has occurred in wholesale markets. One of the new players in retail electricity and gas is the energy service provider or ESP. The ESP can aggregate the needs of many utility customers, and use the economies of scale to bargain for better rates from the distribution companies. Some ESPs also provide the retail metering, billing, and customer service functions, as part of their bundled services. Aberdeen Research, in a July 2001 report, says ESPs need to offer a unique value proposition in order to survive, and cites those offering energy from renewable sources as an example. Aberdeen predicts significant consolidation among ESPs since few of the companies can make a compelling case to retail customers to switch from the established local utility.[42]

In the gas industry, local distribution companies or LDCs have provided distribution, to customers, including scheduling, acquisition, and delivery, as well as the transport and storage functions. Large industrial and commercial customers have had for many years the option to choose their gas suppliers. With deregulation, however, smaller businesses and residential customers can choose among independent marketers for the distribution services, which are separate from transport and storage.

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[39] "US FERC's Massey to market: 'Stop the funny business,' Platts Global Energy, 15 May 2002, http://www.platts.com/stories/electricpower2.html

[40] "NEM Group Seeks National Standards To Offset Enron, Dereg Problems, National Energy Marketers Association, 14 May 2002,
http://www.energymarketers.com/press/DocLocator.cfm?action=list&category=5

[41] "Electric Power Industry Restructuring Fact Sheet," U.S. Energy Information Administration, 28 March 2002, http://www.eia.doe.gov/cneaf/electricity/page/fact_sheets/restructuring.html

[42] Ethan L. Cohen, "Slippery Road Ahead for Internet-Based Energy Service Providers," Aberdeen Group, 11 July 2001, http://www.aberdeen.com/2001/research/08010001.asp .

EIA reports that even in deregulated states, the number of independent marketers varies from state to state, with only a handful (9) in Georgia to over 100 in New York.[43]

Pete Byrne of the Utilities Industry Group, in a presentation at the 2000 DISA conference, outlined three basic processes in deregulation at the retail level: enrollment, metering, and billing/payment. Enrollment interactions include marketing, determining eligibility, selection of the service provider, confirmation of the selection, switching from one service provider to another, and terminating service at the previous provider.

Under deregulation, utilities can unbundle the metering functions they had traditionally provided, and new players including meter reading service providers and meter data managers, in some markets offer these specialized services.   The metering process includes several interactions among the service providers including identification of basic meter data, scheduling and installation of meters, interchange of current meter data, and management of historical data.

Billing and payment processes resemble those found in other industries, although in a deregulated environment, the interactions become more complex because of the additional parties involved in the delivery and metering of energy services. Because of the increased complexity, some utilities have spun off these functions to specialized billing service providers. Billing, of course, needs to be tightly integrated with metering, which in the vertically integrated utility is a given, but with specialized unbundled service providers, requires close coordination between the companies.

Where energy service providers (ESPs) act as intermediaries between the local distribution companies (LDCs) and the customers, the LDCs will bill the ESPs for their combined energy consumption and ESPs will invoice the customers for the individual company usage. Subsequent payments will (or should) flow in the opposite direction, and corresponding remittance or collections data will parallel the payments. Should customers not make the required payments, or if attempts to collect the balances due fail, providers need to terminate the services and suspend further collections efforts.[44]

While enrollment, metering, billing, and customer service may seem like basic business functions, they raise, as Byrne noted, new issues in the retail electricity sector undergoing deregulation. Edison Electric Institute summarized an extensive study of these functions by the consulting firm Putnam, Hayes & Bartlett. The unbundling of these services, from one integrated utility vendor to a collection of companies that may or may not be directly providing the services creates one level of complexity. Before deregulation, residential or small business customers received electric bills with a few basic pieces of information on usage and pricing. With services unbundled, the bills become more detailed to show the various services provided and prices for those services. Pricing also may need to reflect different pricing for base versus peak loads, much like some telecommunications services.

Utilities base their billing for most residential and small business customers on meters installed during earlier times when the utilities needed only overall usage measures to compute the charges.   The companies can estimate customer use at base or peak loads based on previous performance or overall models. However, if bills need to reflect accurate usage at different times of the day, then a large part of the installed base of meters will probably need to be upgraded or replaced.

Another issue is the access to metering information. Use of electric power by a consumer once was a matter between the customer and the utility. With more players in the retail marketplace, more parties

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[43] "U.S. Natural Gas Markets: Recent Trends and Prospects for the Future," Energy Information Administration, May 2001, page 31, http://tonto.eia.doe.gov/FTPROOT/service/oiaf0102.pdf

[44] Pete Byrne, "Data Exchanges in Utility Restructuring," presentation to Data Interchange Standards Association conference, April 2000, http://www.uig.org/frmPresentations.asp

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now have access to the customer usage information, which will need to be protected like other customer data.

Customer enrollment and service issues also will need to be settled. In the highly competitive long-distance telephone market, many customers experienced the practice of slamming, where they were involuntarily switched from one vendor to another. Customers will need to be protected from such unsavory practices, while still leaving open their options to freely choose suppliers. At the opposite end of the process is the issue of service termination. If, for example, the customer pays one of the unbundled services, but falls behind with others, how do the different companies sort out the level of service provided to the customer?[45]

3.2   Current e-business standards and specifications

The utilities industries have become major users of e-business technologies in their current operations, and the deregulation trend will likely increase the adoption of these technologies as basic tools of doing business. The high volumes of transactions and the over-riding need for accuracy in the capture and exchange of information makes the use of electronic interactions imperative. Electronic processes not only enable more information to be transmitted at higher speeds, but they reduce the opportunity for errors and offer a more transparent audit path for regulators.

For e-business to succeed in the utilities (and most other) industries, standards are vital. Standards provide a common language and format that make it possible for all trading partners to develop the processes and systems needed to exchange business information in the restructured industries.[46]

3.2.1   EDI standards

The utility industries use electronic data interchange (EDI) for many business-to-business transactions, particularly in the wholesale gas and retail electric quadrants. EDI, used in many industries for over two decades, provides for computer-to-computer exchange of business data in a standard format. The technology has gained a significant following in manufacturing, transportation, retailing, financial services, and government, where trading partners have high volumes, repetitive transactions, and relatively stable supply chains. The health care and insurance industries will soon see sharp increases in EDI transactions as the a law mandating standard electronic transactions goes into effect in October 2003.[47]

The Accredited Standards Committee X12 (http://www.x12.org), a group commissioned by the American National Standards Institute, writes the EDI standards for North America. The standards consist of generalized messages called transaction sets made up of interchangeable collections of data elements and groups of data elements known as data segments. The messages represent common business transactions such as ship notices, invoices, and purchase orders, as well as some business documents written for particular industries, such as health care claims. Each X12 transaction set has a unique identification number.

Outside North America, the UN's Centre for Trade Facilitation and Electronic Business, known as UN/CEFACT (http://www.unece.org/cefact/), publishes the UN/EDIFACT standards used internationally.

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[45] "Electricity Competition and Consumers: Getting The Rules Right – Competitive Metering, Billing, and Customer Services: What Issues Must Be Considered?" Edison Electric Institute, March 1998, http://www.eei.org/issues/comp_reg/finmtrbl.htm

[46] Pete Byrne, "Data Exchanges in Utility Restructuring," presentation to Data Interchange Standards Association conference, April 2000, http://www.uig.org/frmPresentations.asp

[47] The Health Insurance Portability and Accountability Act of 1996, see http://aspe.hhs.gov/admnsimp/

UN/EDIFACT standards have a syntax somewhat similar to X12's but they follow the same basic principles and architecture.

Because many of the basic messages, called transaction sets in the X12 standard, need to cover many kinds of businesses, individual industry groups often write EDI implementation guidelines for their specific industries. These guidelines identify the transaction sets, data segments, and data elements that best fit the business processes in that industry, as well as recommend specific codes that reflect industry terminology and semantics.

A few groups write EDI guidelines for the North American utility industries. The Petroleum Industry Data Exchange (PIDX, http://www.pidx.org), a division of the American Petroleum Institute, has several implementation guides that apply to natural gas. The guidelines cover financial transactions connected with gas exploration, pipeline operations, supply chain interactions for purchasing and materials management, and well operating data reports for management and regulatory agencies. Most of the electronic documents use ASC X12 transaction sets, although a few follow industry-specific formats. A list of the PIDX transactions follows.[48]

X12 set number	Transaction set name	Guideline/description
810	Invoice	Joint Interest Billing Exchange (JIBE)
819	Operating Expense Statement	Joint Interest Billing Exchange (JIBE)
810	Invoice	Pipeline Operations Information (PIPENET)
830	Planning Schedule with Release Capability	Pipeline Operations Information (PIPENET)
846	Inventory Inquiry/Advice	Pipeline Operations Information (PIPENET)
861	Receiving Advice	Pipeline Operations Information (PIPENET)
810	Invoice	Purchasing and Material Management
832	Price/Sales Catalog	Purchasing and Material Management
850	Purchase Order	Purchasing and Material Management
855	Purchase Order Acknowledgment	Purchasing and Material Management
860	Purchase Order Change	Purchasing and Material Management
865	Purchase Order Change Acknowledgment	Purchasing and Material Management
820	Payment Order/Remittance Advice	Purchasing and Material Management
840	Request for Quotation	Purchasing and Material Management
843	Response to Request for Quotation	Purchasing and Material Management
856	Ship Notice/Manifest	Purchasing and Material Management
869	Order Status Inquiry	Purchasing and Material Management
870	Order Status Report	Purchasing and Material Management
867	Product Transfer and Resale Report	Well Operating Data Exchange (WODEX)
PIDX format	Checkstub Data Exchange	Lease revenue detail
PIDX format	Gas Revenue Accounting Data Exchange	Financial data on gas exploration
Data dictionary	Petroleum Industry Data Dictionary	Standardized business terms and definitions

The Utilities Industry Group writes EDI messages for retail electricity transactions. The organization consists of electric power utilities, energy service providers, suppliers, technology companies, and customers. Its EDI transactions address utility market operations and what it calls supply chain interactions. Utility market operations, as the name implies, cover transactions directly affecting energy

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[48] "PIDX Products," American Petroleum Institute, http://www.api.org/faeb/pidx/catalog/products.html

functions. The latest X12 transactions (X12 standard 4010) implemented for utility market operations include:[49]

X12 set number	Transaction set name	Description
248	Account Assignment/Inquiry and Service/Status	Utility to collection agent and to energy service provider)
650	Maintenance Service Order - Utilities	Meter specific information
810	Invoice	Utility to customer
814	General Request, Response or Confirmation	Customer enrollment and account maintenance
820	Payment Order / Remittance Advice	General utilities transactions
820	Payment Order / Remittance Advice	Remittance advice from billing party to non-billing party
824	Application Advice	Application advice for UIG deregulation transactions
867	Product Transfer and Resale Report	Acid rain allowance transfer reporting to the U.S. EPA
867	Product Transfer and Resale Report	Metered interval consumption reporting
867	Product Transfer and Resale Report	Meter interval and historical usage reporting

Supply chain operations cover purchasing and inventory operations, with the latest X12 transactions (X12 standard 4010) including:[50]

X12 set number	Transaction set name
850	Purchase Order
852	Product Activity Data
855	Purchase Order Acknowledgment
860	Purchase Order Change - Buyer Initiated

The Gas Industry Standards Board (http://www.gisb.org/), now the wholesale gas quadrant of the North American Energy Standards Board, published the fifth release of its EDI implementation guidelines in June 2001. The GISB implementation guidelines include some 45 EDI transactions covering such business functions as contracting, ordering, transportation, accounting for transportation, and administration of pipeline capacity. The transactions are used by natural gas producers, local distribution companies, pipelines, end-users, electric utilities (gas-fired power plants), and independent energy marketers.[51]

While GISB guidelines are developed by voluntary consensus, FERC in the past has mandated use of GISB guidelines for certain transactions; for example Order 587-B in 1997 required the use of GISB

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[49] "Guidelines and Standards," Utilities Industry Group, http://www.uig.org/frmGuideline.asp

[50] "Guidelines and Standards," Utilities Industry Group, http://www.uig.org/frmGuideline.asp

[51] Conversation with Rae McQuade and Joann Garcia, NAESB, and Leigh Spangler, Latitude Technologies, 26 April 2002

standards for certain pipeline transactions.[52] A more recent FERC order (March 2002) covers GISB standards for pipeline capacity release transactions.[53]

The most recent of the EDI standards from GISB, version 1.5 published in June 2001, cover several overall industry processes:

- *Nominations*, where providers order (nominate) specific services that conform to pipeline content, format, and timeliness

- *Capacity release*, which involves the sale of any part of a service requester's contract rights to pipeline or storage capacity, functions that became more economically feasible as a result of deregulation

- *Invoicing*, which includes remittances and accounts statements

- *Flowing gas*, which covers allocations, measurements, and audits of gas at specific locations

Version 1.5 includes the following transaction sets:[54]

X12 set number	Transaction set name	Guideline/description
	Nominations	
873	Commodity movement services	Nomination
874	Commodity movement services -- validation response	Nomination quick response
873	Commodity movement services	Request for confirmation
873	Commodity movement services	Confirmation response
874	Commodity movement services -- validation response	Confirmation response quick response
873	Commodity movement services	Scheduled quantity
873	Commodity movement services	Scheduled quantity for operator
	Capacity release	
840	Request for quotation	Firm transportation and storage offer download
843	Response to request for quotation	Firm transportation and storage bid review
843	Response to request for quotation	Firm transportation and storage award notice
832	Price/sales catalog	Replacement capacity
843	Response to request for quotation	Firm transportation and storage withdrawal offer/bid/award
840	Request for quotation	Upload of withdrawal of offer or bid
840	Request for quotation	Upload to pipeline of prearranged deal
843	Response to request for quotation	Offer upload quick response

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[52] "Standards For Business Practices Of Interstate Natural Gas Pipelines," Federal Energy Regulatory Commission, Docket No. RM96-1-003; Order No. 587-B, 30 January 1997, http://www.ferc.gov/news/rules/data/rm96-1-00k.txt

[53] "Standards For Business Practices Of Interstate Natural Gas Pipelines," Federal Energy Regulatory Commission, Docket No. RM96-1-019; Order No. 587-N, http://cips.ferc.fed.us/rules/rm/rm96-1.0br.txt

[54] "NAESB Wholesale Gas Quadrant Implementation Guides," version 1.5, 18 June 2001, http://www.naesb.org/imp.htm

X12 set number	Transaction set name	Guideline/description
	Capacity release (cont'd)	
843	Response to request for quotation	Offer upload notification
843	Response to request for quotation	Offer upload bidder confirmation
824	Application advice	Offer upload bidder confirmation quick response
567	Contract completion status	Offer upload final disposition
840	Request for quotation	Operationally available and unsubscribed capacity
846	Inventory inquiry/advice	Upload of request for download of posted datasets
846	Inventory inquiry/advice	Response to upload of request for download of posted datasets
864	Text message	System-wide notices
864	Text message	Note/special instruction
843	Response to request for quotation	Bid upload
843	Response to request for quotation	Bid upload quick response
	Invoicing	
811	Consolidated service invoice/statement	Transportation/sales invoice
820	Payment order/remittance advice	Payment remittance
822	Account analysis	Statement of account
811	Consolidated service invoice/statement	Service requester level charge/allowance invoice
	Flowing gas	
860	Purchase order change request	Pre-determined allocation
865	Purchase order change acknowledgement	Pre-determined allocation - quick response
865	Purchase order change acknowledgement	Allocation statement
811	Consolidated service invoice/statement	Shipper imbalance
867	Product transfer and resale report	Measurement information
867	Product transfer and resale report	Measured volume audit statement
814	General request, response, confirmation	Request for information
814	General request, response, confirmation	Response to request for information
Not defined		Authorization to post imbalances
Not defined		Posted imbalances download
Not defined		Request for imbalance trade
Not defined		Request for imbalance trade quick response
Not defined		Withdrawal of request for imbalance trade
Not defined		Request for confirmation of imbalance trade
Not defined		Imbalance trade confirmation
Not defined		Imbalance trade notification

3.2.2 XML vocabularies

The eXtensible Markup Language or XML is a set of standards of the World Wide Web Consortium for transmitting structured data, the kind stored in databases. While similar in some respects to the Hypertext Markup Language or HTML, its extensibility – the ability to define specific vocabularies – gives XML much more power and flexibility than HTML that defines the presentation of information on the Web.

XML therefore is really a set of tools for defining vocabularies that can be expressed in data-exchange specifications or even in defining Web-based services, when combined with recent programming languages like Java or C#. One of the main attractions of XML for business data exchange is its affinity for the Internet, which makes it potentially more affordable for smaller businesses. EDI, while effective for many companies, often requires a large initial investment in software and up to recently, special value-added networks or VANs that carried a high price tag.

With this potential for wide use, XML has drawn a lot of attention from industry groups and standards bodies, including those in the utilities industries, wanting to take advantage of these capabilities. The National Energy Marketers Association, in a white paper published in 2000, advocated writing an industry vocabulary with XML as part of a national energy technology standard.[55]

The relative ease of creating new vocabularies with XML has become something of a curse as well as a blessing for XML. The rapid proliferation of XML vocabularies has forced many of the groups promoting XML for business use, to find ways of getting these various languages to understand each other, a process called interoperability. As more and more XML vocabularies develop, participants in standards groups have become more active and vocal in seeking interoperable solutions.[56]

XML has begun to take hold in some industry applications. The Ontario Energy Board has one of the more advanced uses of XML, a system for retail electric power transactions. The organization's Electronic Business Transactions or EBT system supports Ontario's deregulation program, but unlike many of their counterparts in the United States, most of the power utilities do not have an installed base of EDI to support simultaneously.

While the Ontario EBT system supports the retail electric marketplace, the business processes represented in the system cover exchanges between the independent market operators that administer the wholesale marketplace, distributors that connect the regional grids to the local entities, and local power companies called retailers. The system does NOT service transactions with the individual retail customers, which are the responsibility of the local distributors or retailers.[57]

The EBT system represents the important business processes that contain one or more transactions. One of the larger sets of transactions is called service transaction requests or STRs that cover messages for enrollments, changes in status, usage/history reports, and service drops. Another large class of transactions is invoices covering retailer and distributor invoices, consolidated bills, and settlements. Other types of transactions include remittances, metering functions, application advice messages to acknowledge acceptance or rejection by the receiver's system, and status advice messages.[58]

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[55] "National Energy Technology Policy," National Energy Marketers Association, 2 November 2000, page 8. http://www.energymarketers.com/Documents/NEM_NationalEnergyTechnologyPolicyFinal.pdf

[56] Alan Kotok, "Interoperate or Evaporate," XML.Com, 12 December 2001, http://www.xml.com/pub/a/2001/12/12/kotok.html

[57] Ontario Electronic Business Transactions (EBT) Standards Document, 21 December 2001, page 16.

[58] Ontario Electronic Business Transactions (EBT) Standards Document, Ontario Energy Board, 21 December 2001, pp. 19-20

Ontario's EBT system works though a hub that serves as a store-and-forward device to route messages between trading partners, provide acknowledgements to the senders, and provide an audit trail if needed. Trading partners need to become authorized and certified hub users, before exchanging messages. The hub also checks for conformance with EBT specifications.[59]

The Ontario EBT system uses a transport protocol called Partner Interface Protocol for Energy or PIPE. The PIPE transport protocol consists of three parts:

- Overall message framework
- Delivery framework, defining the flow of EBT messages
- Security protocol to ensure message integrity

Security for EBT messages includes encryption, digital signatures to verify sender identity and message integrity, secure connections, and logon/password routines for authentication. A recipient's Web (HTTP) server must have a valid public key certificate meeting the X.509 standard.[60]

The North American Electric Reliability Council (NERC) has implemented an application of XML in release 1.7 of its E-Tag specification. E-Tag is an XML vocabulary for identification of interchange transactions on the grid between vendors and buyers. The reliability councils that operate the grids use E-tags for load balancing and other control functions.[61]

The Petrotechnical Open Software Corporation (http://www.posc.org/) has written several sets of electronic rules for XML documents called schemas relating to oil and gas exploration and submission of regulatory information. Utility industry systems vendor Excelegy (http://www.excelergy.com/) has written XML schemas for utility business functions that the company markets. The company says its solutions address acquisition, forecasting, trading, scheduling, billing, and settlement.

In Europe, ETSO, the organization of European transmission system operators, has published a set of XML document type definitions or DTDs for scheduling messages. However, ETSO took a systematic approach to the task, first by defining a set of overall business process models, and proposing a common set of identification codes. The group also developed a data dictionary using ebXML core components (see below).[62]

The utility industry standards associations active in EDI have plans for making more use of XML. PIDX announced in May of 2002 that it would focus more on XML to help make it more feasible for companies

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[59] Ontario Electronic Business Transactions (EBT) Standards Document, Ontario Energy Board, 21 December 2001, pp. 7-8

[60] Ontario EBT Data Transport Protocol Version 2.1, Ontario Energy Board, 21 December 2001, pp. 5-6

[61] "Policy 3 – Interchange," North American Electric Reliability Council, Operating Manual (version 5). 20 February 2002, ftp://www.nerc.com/pub/sys/all_updl/oc/opman/Policy3V5-BOTApproved-0202.doc . See also Electronic Tagging — Functional Specifications, version 1.7.06, North American Electric Reliability Council, 22 March 2002.

[62] "ETSO Model," http://www.ediel.org/etso/, 27 March 2002

of all sizes to engage in e-business. [63] In June 2001 PIDX said that it is working in tandem with the Chemical Industry Data Exchange on the development of XML industry specifications.[64]

The UIG also is working on XML. A year 2000 white paper pointed out the potential for XML to support the group's work in supply chain interactions and utility operations. The white paper recommended moving ahead on XML schema development, despite the still unsettled nature of XML standards.[65] UIG has also created an extensive draft data dictionary relating proposed XML element and attribute tag names to its current EDI transactions.[66]

3.2.3   Business frameworks and message protocols

The developers of XML first envisioned the standard as a tool for electronic publishing, to make it easier to produce technical documentation and better manage corporate information from databases that appears in various media. It became clear early on to e-business developers that XML's ability to support structured data gave it potential well beyond document production or management. However, it also became clear that in order for XML to meet the potential for e-business would need more functions than those built into the original standard.

To conduct business electronically, companies -- including government agencies and not-for-profits -- need to find suitable trading partners, establish e-business relationships, discover any established industry conventions or vocabularies, follow agreed-upon business processes, and exchange messages in a secure environment. Because of its extensibility, XML can be shaped into overall frameworks made up of specialized vocabularies or combined with other protocols to perform these functions. But companies and industries also need to agree on using these frameworks, so they all speak the same language at all levels of interaction.

Microsoft Corp. has developed one of these frameworks, called BizTalk that consists of design guidelines for writing XML schemas (the electronic rules for the content and structure of messages written in XML), and a registry of XML schemas meeting the BizTalk guidelines. Microsoft also offers a server that supports BizTalk schemas and messaging. Biztalk messages can be sent over the Web, through e-mail, or with message-queuing protocols such as IBM's MQ Series. [67] BizTalk has attracted significant support from other e-business vendors and independent business consortiums, such as the Open Applications Group.[68]

A more recent e-business framework is Electronic Business XML or ebXML, a joint initiative of the Organization for the Advancement of Structured Information Standards (another OASIS acronym) and the UN's Centre for Trade Facilitation and Electronic Business that uses the acronym UN/CEFACT. The

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[63] "New Vision for API PIDX Unveiled at 2002 Conference," American Petroleum Institute, 13 May 2002, http://api-ec.api.org/media/index.cfm?bitmask=001007000000000000

[64] "PIDX and CIDX to Partner in Developing XML Standards for the Petroleum and Chemical Industries," American Petroleum Institute, 20 June 2002, http://www.api.org/faeb/readingroom/releases/20010620.html

[65] "XML White Paper," Utilities Industry Group, 7 June 2000, http://www.uig.org/upload/Articles/XML White Paper FINAL10.pdf

[66] "UIG-XML Data Dictionary," Utilities Industry Group, 26 May 2000, http://www.uig.org/upload/Articles/data dictionary draft 060400.pdf

[67] "BizTalk Framework," Microsoft Corp., http://www.biztalk.org/home/framework.asp

[68] Christopher Kurt, "Implementing OAGIS within the Microsoft BizTalk Framework," 14 June 2000, http://www.openapplications.org/downloads/whitepapers/frameworks/biztalk_oagi_ebizwp.pdf

ebXML specifications cover several business functions including message structure and management, registries for industry vocabularies and schemas, company profiles also stored in registries, technical aspects of trading partner agreements, and business process definitions. Another part of the ebXML specifications, as of May 2002 in final draft, covers semantic interoperability -- called core components – that relate common terms in different XML vocabularies or EDI implementations.[69]

The ebXML framework has attracted support from vendors, standards groups, and industry organizations, including EDI standards organizations that see ebXML as a way to build on the previous investment in EDI. PIDX has expressed an interest in ebXML, but earlier had announced support for BizTalk. Many groups, like PIDX and Open Applications Group, see a need to keep their options open until the XML standards picture clarifies.

An emerging set of specifications called Web services are based on XML and provide many functions needed for e-business. The most mature of these specifications include:

- Simple Object Access Protocol (SOAP), for messaging
- Universal Description, Discovery, and Integration (UDDI), for directories and registries
- Web Services Description Language (WSDL), for standard descriptions of network services

Web services are online business functions accessible through the Web. Developers envision writing business applications by building these components together into services that provide value to the companies or organizations that offer them to their customers. The Web services specifications were first written by Microsoft, IBM, and other large vendors, who have offered them to the World Wide Web Consortium for standardization. The companies have also formed a Web Services Interoperability organization to define common subsets and write conformance tests to encourage interoperability among the individual specifications.[70]

Some overlap has developed among these frameworks. Microsoft's .Net (Dot-Net) initiative, based largely on Web services, includes BizTalk. The ebXML messaging services use a variation of SOAP with the capability to add attachments. The ebXML messaging specifications are designed to provide reliability functions and security comparable with EDI.[71]

The Electric Reliability Council of Texas (ERCOT) that operates the Texas power grid, is building an ebXML messaging system to handle its electronic business transactions. The system, developed by Systrends, an energy systems vendor, supports two types of activities: services and actions. The messages exchanged in the system contain largely EDI data, but use the ebXML messaging format as the transport medium.

ERCOT's system supports upload and download services, each with request and response actions. It also supports a directory service that provides an index of folders. The stringent ebXML reliable messaging functions require persistent storage of messages in case recovery of messages is needed. The stable document identifier enables persistent storage of messages, thus making possible ebXML's reliable messaging. ERCOT also takes advantage of ebXML's security features. The ERCOT application includes public key and SSL certificates.[72]

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[69] Pim Van Der Eijk, et al., "Introduction to ebXML," Professional ebXML Foundations, 2001, WROX Press, pp. 11-17.

[70] See http://www.w3.org/2002/ws/ for the W3C's Web services activity statement and http://www.ws-i.org/home.aspx for information on the Web Services Interoperability Organization.

[71] Alan Kotok and David R.R. Webber, *ebXML: The New Global Standard for Doing Business on the Internet,* New Riders Publishing, August 2001, ISBN 0735711178, pp. 254-266.

[72] Conversation with Dick Brooks, Systrends, 5 March 2002.

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The gas industry has also moved ahead on secure EDI over the Internet. As part of its release 1.5, GISB published specifications for electronic delivery of its messages, which it groups under the generic term electronic delivery mechanisms or EDM. The EDM specifications endorsed secure transmission of EDI data over Hypertext Transport Protocols or HTTP, using the EDIINT AS2 standard developed by the Internet Engineering Task Force. FERC had ordered (Order 587-G) that pipelines use the Internet as a standard means of communication, to help solve the problem of many incompatible electronic bulletin boards in use by different service providers.[73]

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[73] "Electronic Delivery Mechanism Standards," Gas Industry Standards Board, Version 1.5, 18 June 2001.

4. Conclusions and recommendations

4.1. Conclusions: Utilities industries can build on their rich experience with standards to help achieve the goals of deregulation

4.1.1. The goals: more services, more control, but continued reliability

The North American utilities industries have become a leading example of the value of standards to business. The industries' establishment and adherence to voluntary standards have enabled their companies to shed close regulation while maintaining a successful record of stability and reliability.

NERC, for example, provides a system of interconnected regional organizations with common voluntary business practices that has helped make possible deregulation of the electrical industry. Likewise, the gas industry's system of producers, pipelines, and local distribution companies working through voluntary industry standards, provide customers in the United States and Canada with a stable marketplace, while deregulation has progressed over the past two decades.

The promise of deregulation to the utilities' customers is higher levels of service and more control over energy costs, while at the same time maintaining stable and reliability delivery of supplies. The industries are seeing new kinds of business processes develop, with more trading partners, different kinds of trading partners, and new ways of doing business with each other. With deregulation occurring both at the wholesale and retail levels, the utilities industry has begun adding new types of trading partners to its e-business networks: energy marketing companies, electronic marketplaces, energy service providers, and specialized service providers for billing and metering. These companies will interact with each other in different ways than before that will require new kinds of electronic transactions. Deregulation will also make it possible for companies outside the utilities industries, such as banks, to begin working with utilities to offer new kinds of electronic services.

As much as the utilities may want to provide new and different kinds of e-business services, utilities still need to maintain the reliability and security of their energy production and distribution networks. Therefore, any new e-business standards or services developed from those standards cannot compromise the basic responsibilities of the utilities to the consuming public to maintain adequate supplies of energy at stable prices.

In the first half of 2002, the industry faced a set of new challenges from revelations of some energy marketers falsifying or inflating transactions. The charges (and some admissions) have eroded public trust in the industry and in some cases adversely affected investor confidence. While the revelations will require further investigation to determine the full story of these transactions, the industry can still take further steps to help prevent their recurrence. Among those steps are open standards to provide more transparency, traceability, and auditibility to industry transactions. Open standards cannot guarantee these practices will no longer occur, but they can make it more difficult to engage in and hide these activities.

4.1.2. Building on the solid base of e-business experience

For e-business in the utilities industries, groups like PIDX, UIG, and NAESB have also shown the value of voluntary specifications for the development of common EDI messages that encourage more vendors to build systems for the industry, which results in more economies of scale and lower costs.   In an industry built in good measure on voluntary standards, e-business now has an opportunity to help fulfill the larger promise of deregulation. But to achieve this promise, the industry needs to take e-business standards to a new level and with more coordination than before.

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To achieve this promise requires building on this base to maintain the security and reliability needed by the industries and its customers, while at the same time providing the flexibility needed to meet the expectations of higher levels of service, and to take advantage of the latest developments in technology. And if these requirements are not enough, regulators will likely demand increased transparency in electronic transactions, to connect the flow of information between producers and customers at all levels.

Recent developments in e-business standards offer tools to help the utilities industries meet these expectations. The Open-edi Reference Model, a document developed by the international EDI standards community and an ISO standard, takes a generic approach to electronic business, in effect moving up above the levels of specific technologies, business content, or individual organizations. The model provides two different, but complementary views of e-business interactions:

- *Business operational view,* that includes the rules for conducting business (conventions, agreements, and mutual obligations), as well as the semantics or terminology reflected in the business data

- *Functional service view,* that addresses the information technology used in the interactions, in terms of functional capabilities, technical connections, and interchange protocols

By separating the business operational view or BOV from the technology represented in the functional service view (FSV), business people can focus on defining their current and desired business processes independent of technological solutions. This approach "lets business be business" and helps capture the needs and requirements of e-business in terms that business people understand. The approach also enables the application of multiple technical solutions, represented by the FSV, to meet the business objectives, thus encouraging interoperability among the solutions.[74]

Some of the more recent e-business specifications in the utilities industry have started taking this approach. The UIG, NAESB, Ontario Energy Board, and ETSO in Europe have defined business processes either in advance of or in tandem with message development.

Utilities can also adapt the experiences in other industries to help meet these expectations. In retailing for example, companies in the supply chain have begun collaborating more closely, sharing more and different kinds of information, to help reduce costs and provide more choices for customers. That same process can take place in utilities, with benefits for all parties.

One of the lessons that retailing offers is the need to connect all parties in the supply chain into a common set of business processes, so the different parties have a common vocabulary and frame of reference for increased collaboration, a process called Collaborative Planning, Forecasting and Replenishment (http://www.cpfr.org/). This process recognizes that trading partners need to work together to identify and correct dislocations in the supply chain. This process resembles that found in the utilities industry, where an increase in business activity in one part of the country, for example, can mean an increase in overall energy consumption and without all parties in the supply chain cooperating, dislocations can occur. Thus the utilities industry may need a common set of business processes that overlap the traditional wholesale/retail and gas/electric boundaries.

The work of the Ontario Energy Board described in section 3.2.2 takes this approach to a large extent. The group first defined a set of business processes, identified the sets of transactions, and individual messages, then wrote XML schemas for each of the messages. It can serve as a model, but expanded to cover interactions for a wider set of business interactions and trading partners.

Another lesson from retailing is the integration of point-of-service (POS) devices, such as bar code scanners, radio-frequency ID tags, and in-store kiosks, into an overall architecture for the industry. This widespread use of POS technology is similar in concept to the widespread use of meters to measure retail energy use. In the retail world, the Association for Retail Technology Standards (ARTS) defined a data model and overall business processes for interoperability in a retail enterprise that includes both

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[74] Information Technologies – Open-edi Reference Model, ISO/IEC 14662:1997(E), pp. 5-8.

internal as well as external exchanges. The proposed architecture includes interactions among suppliers, financial institutions, and headquarters systems outside the boundaries of the stores, as well as exchanges between internal systems, including POS devices.[75]

The financial services industry also offers models for e-business in the utilities industries. Financial services have a long record of working under regulation, are critical to the functioning of society, but have used technology built on open standards to provide new and innovative services. They also have strict requirements of transparency and audittibility. Companies in financial services have been among the leaders in the development of XML vocabularies, and can become potential partners with utilities for the provision of billing and collections services.

4.2   Recommendations: a strategy for e-business standards

Because of the work done by e-business standards groups like PIDX, UIG, and NAESB, the utilities industry has a solid base in which to build. Much of that work has involved EDI transactions, but the organizations also recognize that XML will play an important role in growing the use of e-business. The challenges of deregulation, with new business processes, more and different kinds of trading partners, but still with the need to provide secure and reliable service will probably mean supporting both EDI and XML technologies for the foreseeable future.

With the specter of supporting multiple technologies, the industry standards groups will likely need a reference framework of business processes that can provide a roadmap for the cataloging of current transactions and the development of future messages. The Open-edi Reference Model mentioned above can help here.

The business processes described in the Open-edi Business Operational View identify the parties involved in the interactions, the messages sent between the parties, the order or choreography of those messages, and the major information blocks contained in the messages. Modeling techniques such as UML (as used by ETSO in Europe) can help identify and describe those business processes, down to fine level of granularity.

Some industry participants – e.g., UIG, NAESB, Ontario Energy Board, and ETSO – have started taking this approach for their domains or operations. The industry now needs to conduct this exercise for industry-wide business processes. An overall industry business process model will help integrate EDI and XML implementations, as well as connect processes that cross the traditional industry quadrants, which can also help provide more transparency in tracking transactions from the wholesale to the retail level.

Where the processes indicate high frequency or volumes of transactions, stable message content, and direct interactions (i.e., without intermediaries), the processes will likely support EDI transactions. For example, industrial users like paper mills and other manufacturing plants will probably use EDI transactions with their power and gas suppliers to report metering data and receive invoices.

Where the interactions have less frequency, smaller volumes, variable content, and the need to support multiple channels, XML messages will probably make more sense. An example of this kind of transaction is trades of excess capacity often made by energy marketers.

NERC already uses XML in the wholesale electric quadrant for load balancing, and the Ontario Energy Board has defined a set of XML messages for some retail electricity transactions. Further XML use by utilities would lend itself to integration with vocabularies used in other industries, and the financial services industry offers a promising model for XML development. For example, energy service providers

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[75] "REDX, Retail Enterprise Data in XML, ARTS, undated, http://www.nrf-arts.org/download/REDX_Project_Overview.PDF

may want to partner with banks for billing services. Many banks are using the Interactive Financial Exchange Forum specifications (http://www.ifxforum.org/) for retail banking, and a common solution between utilities and banks may require connecting the banking and utilities XML vocabularies.

Another mature XML vocabulary in financial services that can offer guidance to the utilities industry is the Financial Products Markup Language or FpML (http://www.fpml.org/). This vocabulary provides a protocol for trades of complex financial products, such as swaps and derivatives. These transactions are also time-sensitive and working in an environment of increasing regulatory scrutiny. FpML thus could provide a model for applying XML to energy marketer transactions.

Still another XML vocabulary from the financial world that could apply to the utilities industry is the eXtensible Business Reporting Language or XBRL (http://www.xbrl.org/). This vocabulary began with exchange of common accounting documents such as financial statements, but is expanding to include regulatory reporting. Since some regulatory reports are already covered by EDI transactions, XBRL may provide a way of extending those capabilities to smaller businesses with less complex or infrequent reports.

The utilities industries will find an open overall roadmap of business processes, independent of technology, can provide a form of future-proofing that will enable the industries to adapt to innovations in e-business technology. The ebXML specifications offer an architecture built on business process definitions for this purpose, and when the sections on semantic interoperability get completed, also offer a means of connecting the technical implementations at a fine level of granularity.

However, the development of Web services offers many opportunities for innovative Web-based services that utilities and their trading partners can offer to customers. An open overall architecture will enable the utilities industry to adapt these new Web services while still meeting their obligations for stability and continuity.

About Data Interchange Standards Association

Data Interchange Standards Association (DISA) is the primary source and leading force for driving e-business standards development, maintenance and implementation. DISA leverages its remarkable history - close to 15 years of hands-on experience energizing the digital marketplace - to fortify its core mission: to serve the diverse e-business arena and promote its suite of tools and technologies. By continuing to strengthen this primary mission, DISA in turn enhances the growth of the organizations it supports and the e-business community at large.

Home to numerous e-business organizations, DISA helps individuals and the business community improve business processes, reduce costs, increase productivity, and take advantage of new opportunities. At present, DISA manages organizational administrative and standards development processes for the:

- Accredited Standards Committee (ASC) X12, which also serves as the entry point for the United States into the United Nations/Electronic Data Interchange for Administration, Commerce and Transport, an international standard relating to the exchange of trade goods and services
- Chemical Industry Data eXchange (CIDX)
- Hotel Electronic Distribution Network Association (HEDNA)
- Interactive Financial eXchange (IFX) Forum
- Meat & Poultry XML (mpXML)
- Mortgage Industry Standards Maintenance Organization (MISMO)
- OpenTravel Alliance (OTA)

The types and levels of support required by these organizations vary significantly. Driving membership recruitment and retention, DISA develops strategic plans to foster commitment and participation from vendors and users, implements effective marketing and communications campaigns, and maintains financial and business records. In the area of meeting facilitation and coordination, DISA provides a range of logistical services, including on-line registration, event promotion, and attendee reports as well as solicitation of meeting sponsorships for both virtual and face-to-face meetings.

DISA designs and maintains a customized, interactive and engaging Web site to promote an organization's activities and products. Working in concert with member and complementary organizations to generate awareness and recognition on important initiatives, DISA relays timely information to highly targeted media, analyst, and organizational contacts, and participates in relevant conferences and trade shows. To facilitate implementation of an organization's products, DISA offers extensive publications order and fulfillment services for standards and implementation guides in both hardcopy and electronic formats.

In essence, DISA's experience and expertise drive the vision and fulfill the mission of each organization it proudly serves.

About the author

Alan Kotok (akotok@disa.org) is DISA's Director of Publishing and editor of *E-Business Standards Today*, published by DISA as an online daily newswire and in a weekly newsletter. He previously served as DISA's Director of Education and as Standards Manager for the OpenTravel Alliance.

Before joining DISA in 1999, Alan served 10 years with Graphic Communications Association (GCA) as Director of Management Technologies and then as Vice President for Electronic Business. Before joining GCA, he served 15 years with the U.S. Information Agency in the United States and overseas, becoming chief of the agency's technology planning staff.

He is the author of two books, most recently *ebXML: The New Global Standard for Doing Business on the Internet* (with David R.R. Webber), New Riders Publishing, August 2001. Alan also writes frequently for the information technology trade press, and is author of DISA's previous white papers on e-business standards.