The IT/OT integration imperative for utility distribution businesses
Aligning IT/OT technologies to drive business benefits

The integration of information and operational technologies—and, critically, the new combinations of data that such convergence generates—is fundamental to the evolution of the digitally enabled grid and a key enabler of future business requirements for distribution companies.

This combined data is essential to obtaining the potential value of smart solution deployment into the network. Without it, the network cannot achieve the potential efficiency and effectiveness of a smarter network, and the ability to offer new services will be curtailed.

Utilities are in overwhelming agreement on this point: more than three-quarters of distribution companies in Accenture’s 2016 IT/OT survey recognize IT/OT integration as highly important for delivering their future business requirements. But when asked how much progress they have made in achieving such integration, 80 percent of utility executives stated that their companies had not yet started IT/OT integration or are only at strategy formulation and initial framework deployment phases. As IT/OT moves from aspiration to reality, the challenges are becoming more evident.
Figure 1. Accenture’s *Digitally Enabled Grid* program, 2016 IT/OT survey: importance of IT/OT integration and current status of deployment.

How important do you see IT/OT integration as an enabler for delivering future business requirements?

- Moderate importance: 22%
- High importance: 78%

Which stage of IT/OT integration best fits your current status?

- Integration has been completed: 5%
- A large-scale program in underway: 15%
- At the initial deployment stages: 23%
  - Governance, data model definition, data quality policy, system architectures and pilots
- At the strategy stage: 41%
  - Convergence strategy, business case, roadmap
- No IT/OT executed to date/nothing yet started: 16%

Base: All respondents.  
Source: Accenture’s *Digitally Enabled Grid* program, 2016 IT/OT survey.
Defining IT/OT integration

One difficulty inherent in any discussion about IT/OT integration is defining what the convergence actually means in practice.

Broadly, IT/OT integration can be defined as bringing together the data and information from operations, enterprise systems and external sources, powered by advanced analytics.

There are two aspects of the growing convergence between IT and OT assets:

Technology-driven convergence
While historically the realms of IT and OT had very different purposes, technologies and protocols, there has been a growing degree of convergence. Operational technologies have increasingly adopted some traditionally IT-focused components such as Internet Protocol (IP) solutions and Windows® operating systems. The growth of the Industrial Internet of Things (IIoT) potentially adds millions of assets using Internet protocols rather than the traditional industrial protocols with which distribution utilities are familiar.

Business-driven convergence
More sophisticated analysis and management of the distribution network is being supported by the increasing data availability generated from the digitally enabled grid.

This report focuses on the role of IT/OT in driving business benefits through improved integration of previously disparate datasets. Using our previous definition, we can frame how IT/OT integration provides the data access foundations for the digitally enabled grid and begins to articulate what added business value is at risk if not successfully delivered.
Business drivers for IT/OT integration

- Growth of the digitally enabled grid is resulting in the deployment of potentially millions of new intelligent grid devices into a distribution network—including smart meters, line sensors and on-load tap changers—all generating valuable information across all parts of the business.

- The increasing complexity of managing distribution networks is driving utilities to look for improved approaches to optimize their systems, such as incorporating real-time weather information into distributed generation management and automated rule-based control of assets.

- New business models are yielding services that can only be delivered when business data and operational decisions are brought together, such as the purchase of network services from third-party storage operators.

- Regulators are pushing utilities to do more with less. At the same time, in many mature countries, overall energy consumption is flat or declining while peak demand remains constant or is increasing—thereby further straining distribution assets while undercutting traditional energy-consumption-based cost recovery models.

- New distribution assets delivered with significant embedded sensor technologies, combined with communications and analytic technologies, can yield faster, more accurate insights that optimize and prolong asset life.
IT/OT integration—an enabler for business benefit realization

In Accenture’s 2016 IT/OT survey: The role of IT OT integration in enabling the future distribution network, we asked utility executives to identify the high-level benefit areas they expect to see from IT/OT integration supporting core business functions and operations.

Three out of four executives identify enhanced decision making resulting from the analysis of operational data as the area with the greatest benefit potential. Capabilities such as enterprise asset management, network planning and workforce management would clearly benefit from more granular, timely data from the operational systems. It is clear that executives expect IT/OT integration to support the core business capabilities, making better use of internal and external data sources to improve decision making and provide better service levels.

However, it is also worth noting that IT/OT integration is also expected to provide some back-office benefits as well, reducing manual handoffs that can be time-consuming and error-prone, as well as supporting an overall improvement in reporting systems.

Distribution utilities identify a number of priority capability areas that IT/OT integration would greatly facilitate. These areas cover a broad range of key business issues, from network modelling and crew management to business intelligence and electric vehicle load optimization.

But three areas in particular are rated as the highest priorities:

- Unplanned outage management
- Asset management
- Integrating distributed generation through monitoring and control

Figure 2. Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey: IT/OT integration benefit areas.

From a high-level perspective, to what extent do you see the following areas benefiting from IT/OT integration?

<table>
<thead>
<tr>
<th>Area</th>
<th>To no extent/no benefit</th>
<th>To a moderate extent</th>
<th>To a great extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved decision making through analysis of operational data</td>
<td>30%</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Improved real-time operations via incorporation of external data</td>
<td>54%</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Improved customer service levels</td>
<td>8%</td>
<td>46%</td>
<td>46%</td>
</tr>
<tr>
<td>Reduction of manual interfaces/handoffs between IT and OT systems</td>
<td>5%</td>
<td>62%</td>
<td>32%</td>
</tr>
<tr>
<td>Financial return from existing investments in the smart grid</td>
<td>14%</td>
<td>58%</td>
<td>28%</td>
</tr>
<tr>
<td>Optimized business and regulatory reporting</td>
<td>16%</td>
<td>57%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Base: All respondents, excludes “Not applicable” answers.
Source: Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey.
Figure 3. Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey: capability priority areas.

Which of the following capability areas do you expect IT/OT integration to be of highest priority for your company?

- Unplanned outage management: 54%
- Advanced asset management: 49%
- Distribution connected generation monitoring and control: 35%
- Workforce/crew management: 22%
- Network modeling: 22%
- Volt/VAR / Voltage-reduction management: 22%
- Planned outage management: 19%
- Demand-side management: 19%
- AMI data optimization: 19%
- Business intelligence (e.g., reports, dashboards, KPIs, etc.): 16%
- Storage monitoring and control: 11%
- Revenue protection/assurance: 8%
- Electric vehicle load optimization: 3%
- Beyond-the-meter services: 3%

Base: All respondents; excludes "Not applicable" answers.
Source: Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey.

Within top three
In the following sections we look in more detail at the specific advantages that IT/OT integration could drive within these three areas.

It is worth noting that the component parts of these priority capabilities are also of value across a much broader range of the business’s activities. For example, the field crew optimization and network modeling components of unplanned outage management also considerably enhance planned outage management. Therefore, the business case should be assessed more broadly than one capability at a time.
Outage management

Restoring power in the event of an unplanned outage is a major concern for all utilities. In North America, the ability to restore power rapidly is a top driver of customer satisfaction for many utilities, and a utility’s reputation can be seriously damaged by high outage levels.

For European utilities, outage management is equally important, given customer expectations of very low interruption frequency and duration, in addition to the penalty structures for poor reliability built into many regulatory models.

Beyond the distribution business itself, the ability to manage outages more quickly and efficiently offers considerable socioeconomic benefits. For example, the US Department of Energy’s Interruption Cost Estimator (ICE) tool\(^2\) enables a broader cost estimate of interruptions. These range from the inconvenience to residential customers up to the critical impact businesses can suffer as the result of an outage. What the ICE tool demonstrates is that, when calculated on this more holistic basis, the costs of outages far exceed the lost revenue and operational impacts on utilities themselves.

The management of unplanned outages has evolved progressively from early trouble-call management solutions through to modern outage management systems, many of which can provide automated network reconfiguration capabilities to speed the restoration of power to customers. From an IT/OT integration perspective, the outage management system is an ideal illustration of the potential value of increasing the degree of data integration and remote control. For example, smart metering can provide near-real-time monitoring of outage status, allowing improved fault identification, particularly for outages on long radial lines in remote areas, as well as nested network failures in more suburban and urban areas.

For most utilities, the current process to respond to an outage and restore power is a critical driver of cost. It requires a number of processes, each of which must follow in sequence, with relevant information managed through a series of “handshakes” and “hand-offs” between control rooms, dispatchers and maintenance crews. Being able to enhance situational awareness across that chain with data that addresses fault identification, location and fault data from various sources as well as information about crew availability and proximity to an event can help utilities achieve considerable savings. More sophisticated data can even identify and analyze the optimal deployment of crews to avoid excessive overtime payments.

Management of unplanned outages can also be significantly improved by more effective automation and planning that is possible by integrating data from multiple sources. Advanced switching capabilities in the medium-voltage network would enable utilities to optimize the customer experience, ensuring that as many consumers as possible experience little to no downtime. For example, many medium-voltage networks in Europe are built in a ring structure but operated in a radial manner. Remote switching can alter the as-operated network, isolating the fault and limiting the number of customers affected. Not only does that prevent inconvenience to customers, but could boost utilities’ revenue, as aggregate consumption will rise as more effective, accurate planning means fewer customers are disconnected.
While the scale and types of benefits of advanced unplanned outage management vary between companies, they are commonly broad in scope and significant in size.

**Fault location, isolation and service restoration (FLISR)**
- Ability to combine SCADA, smart meter, field reports and customer notifications with an accurate, as-operated network connectivity model to identify fault locations
- Rapid switching analysis allows the optimum circuit isolation approach to be identified and updated as new information arrives and field work is completed; note: this capability is also extremely valuable to planned outage management
- Improved identification of potential outage causes
- Support of automated switching to reduce the number of impacted customers—mainly on the medium-voltage network

**Workforce optimization**
- Identification of optimal workforce scheduling, taking into account team locations and additional factors such as overtime costs
- Improved identification of parts requirements

**Customer service**
- Improved estimation of time to restoration
- Support of more informative customer interaction through new channels such as social media and websites
- Reduction in the overall duration of outages and the resulting costs

**Societal**
- Reduction in loss of load

**Brand and regulation**
- Improved outage performance—interruptions and duration
- Higher customer satisfaction

Business benefits from IT/OT integration-enabled outage management
Advanced asset management

Advanced asset management is a clear priority capability area that utilities are targeting for improvement from IT/OT integration.

This prioritization reflects the general importance of asset management to many distribution network companies. Aging assets, reinforcement requirements from distributed generation deployment and constraints on accessing assets—particularly in cities—are increasing the pressure to improve the life-cycle management of assets. Additionally, more moves toward incentive-based regulation around the globe increases the need for asset managers to deliver more effective use of the portfolio of assets in their care.

Asset management today is largely characterized by limited and often poor-quality, historical data. Many asset management decisions are based on statistical models, such as failure analysis tools that use "heuristic" scoring of asset health that may not accurately reflect the true condition and performance of those assets in the grid. For example, asset failure probability curves are rarely informed by actual failure data, instead relying on theoretical analysis and technical life assessments from the manufacturer. With the advent of more accurate, real-time flows of data from the smart grid, utilities will be able to make more informed, timely decisions about their assets.

However, the ability to effectively harness data within asset management planning will also require analytic tools and skills that most utilities may currently lack. But these tools and skills will be essential for distribution companies to move successfully from planning policies based on largely historic statistical models to nearer real-time data that can support more granular, asset- and circuit-specific actions and interventions. Accurate data flows from assets can also enable distribution companies to take account of their operating environment's unique conditions in order to make decisions that reflect their real-world context.

Monitoring asset health and performance in real-time could enable utilities to make more effective engineering decisions, as well as plan and allocate capital expenditure more accurately and effectively. That capability will become increasingly important as regulatory funding becomes more incentive- and performance-based.
Business benefits from IT/OT integration-enabled asset management

While the scale and types of benefits from advanced asset management differ between companies, common benefits include:

**Optimized life-cycle costs**
- Asset-specific maintenance approach based on real-time monitoring
- Risk-optimized replacement

**Reduced reinforcement costs**
- Monitoring and identification of renewable hosting capacity
- Identification of optimal assets for reinforcement, support through demand response or through storage deployment

**Reduced outage costs from asset failure**
- Improved understanding of failure causes and rates based on actual asset data
- Reduced strategic spares requirements

**Societal**
- Improved outage interruptions

**Brand and regulation**
- Asset maintenance and replacement decisions made on a basis of fact
- Reduction in significant asset failure outages based on shift from “run-to-fail” mentality to “risk-based maintenance and replacement”
The increasing deployment of distributed generation (DG) is raising big challenges and costs for distribution companies that need to reinforce the network in order to manage these new forms of supply. While small to moderate quantities of DG can often be incorporated into a distribution network with limited negative impacts—and sometimes benefits—there comes a tipping point where utilities have to look for new approaches. Traditionally, this has been through network reinforcement to increase capacity. However, due to the high costs of this approach, many utilities are turning toward digitally enabled solutions as an alternative.

These smart approaches to DG integration require the availability and analysis of considerable flows of data. Currently, that data is not often readily available, particularly for small-scale DG. Many distribution companies, for example, have little if any visibility into prosumer systems across the grid and have to estimate the size and timing of DG exports to the grid. Yet, utilities expect to see grid faults increase substantially by 2020 as a result of the growth in DG technologies. The integration of IT/OT data will be essential for distribution companies to achieve more efficient integration of DG, limiting the requirements for large capital reinforcement spend or any adverse impacts to the network reliability.

We see three progressive phases or levels of IT/OT integration that will enable distribution companies to manage the impact of DG more effectively. The first, basic level sees DG output data incorporated into network planning. The next level achieves real-time network monitoring supported with output data from DG and enables the distribution company to take actions, specifically curtailment of DG output to optimize grid stability. The most sophisticated scenario sees grid operators empowered with technology, such as smart inverters, that allow them to control services from DG beyond curtailment and create a more flexible, responsive grid. These include the ability to flex output, control voltage and draw additional power in response to fluctuations in demand.
While scale and types of benefits from smarter DG integration differ between companies, common benefits include:

**Enables new, lower-cost, integration options**
- Non-firm capacity connections
- Curtailment and flexing of DG outputs

**Supports identification of hosting capacity levels**
- Identification of asset-loading levels in vicinity of DG systems
- Supports cost-reflective connection pricing and network location incentive pricing for new DG systems

**Opens potential for new DG services**
- Smart inverter-enabled solutions that can support grid operations, such as frequency control and reactive power.
- Virtual power plant enablement
- Integrated operations with storage capacity

**Societal**
- Increases the potential rate at which DG can be added to the network to meet policy objectives

**Brand and regulation**
- Meet regulatory targets on DG deployment
IT/OT deployment challenges

While the potential of IT/OT integration shows great promise, benefit realization takes time. Respondents to Accenture’s survey cite a number of obstacles to making progress.

Chief among these are the requirements to overcome cultural barriers and organizational silos, developing a business case to justify the cost of implementation and the ability to evolve legacy systems. IT/OT integration is recognized as a broad change program impacting all areas of the business. However, more than half of respondents said that their current IT/OT integration capabilities had a significant need for improvement, and 43 percent said they had some need for improvement.

An additional concern for utilities contemplating an IT/OT integration program is the status of their analytics capabilities. Analytics is the core capability for driving value from the increased information availability IT/OT integration provides. However, many utilities executives see significant need for improvement across all components of the analytics capability.

In addition, since we started surveying in 2013, the perceived need for significant improvement to analytics capabilities has been rising. This increase suggests that businesses are either struggling to obtain the improvements they seek, or that they increasingly recognize the importance of analytics to their business.

Figure 4. Accenture’s Digitally Enabled Grid program, 2016 IT/OT integration: key challenges to IT/OT integration deployment.

What are/have been the most challenging aspects of IT/OT integration in your business?

- Overcoming cultural barriers and organizational silos: 65%
- The business case/cost to implement: 52%
- Status of the legacy systems/ability to evolve to IT/OT integration: 48%
- Increased/changed cybersecurity implications: 35%
- Poor data availability and quality: 29%
- Limited skills availability: 23%
- Risk to ongoing business processes: 13%
- Multiple protocols and standards: 13%
- Solution unavailability: 10%
- Managing large data volumes: 10%
- Regulatory barriers: 3%

Base: All respondents.
Source: Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey.
Figure 5. Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey integration: maturity of your current analytic capabilities.

How would you assess the maturity of your current analytic capabilities in each of the following areas?

Percentage of respondents indicating a significant need for improvement:

<table>
<thead>
<tr>
<th>Area</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data quality (accuracy and precision)</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>Statistical analysis/data scientist skills</td>
<td>59%</td>
<td>59%</td>
</tr>
<tr>
<td>Data governance</td>
<td>57%</td>
<td>57%</td>
</tr>
<tr>
<td>Data visualization</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>Data availability (detail, gaps, timeliness/currency)</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Data integration across sources (integrate data from consumer, weather, etc.)</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Analysis toolsets (coverage/ completeness)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to real-time data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data latency (time delay of systems)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Base: All respondents.
Source: Accenture’s Digitally Enabled Grid program, 2016 IT/OT survey.
Recommendations for IT/OT integration deployment

IT/OT integration holds the potential to produce considerable business benefits; however, achieving this potential will require distribution companies to overcome a number of barriers.

First and foremost among the barriers is the need for a new approach. Despite the prominence of technology in the description of IT/OT integration, the solution is not primarily systems-based. IT/OT cuts across the traditional boundaries that have largely defined distribution businesses to date. Whether between operations, business and IT or between the control center and the field force, IT/OT integration is fundamentally about making information available where it has the greatest impact and benefit, irrespective of the organizational silo responsible for that information. And with those new forms of information comes the requirement for new talent, with new skills likely to be very different to those distribution companies have attracted and retained in the past. And the current skills analytic and data gap is a significant inhibitor of the potential value new forms of integrated data will generate.

Developing business cases for IT/OT integration also needs to take into account the new complexity of benefits and value that will be dispersed across traditional capabilities and departments. In addition, existing regulatory frameworks and incentives may have to evolve to reflect the new capabilities and performance metrics that IT/OT will support.

On the security front, greater connection between previous stand-alone systems and datasets could increase vulnerability to cyber attack. Many utilities may be underestimating the cybersecurity risks they face from an expanded attack surface to which IT/OT integration gives rise. The recent attack on the Ukrainian grid, plus the growing evidence of cybersecurity weaknesses in some Internet of Things devices are starting to increase the appreciation that IT/OT integration must be designed and operated with security as a fundamental consideration.

The momentum behind the requirement for IT/OT integration is considerable. Many of the pressing challenges and opportunities facing distribution utilities hinge on the ability to successfully combine data and services from previously distinct domains. Our research highlights that utility executives are keenly aware of the significance of getting IT/OT integration right and moving ahead decisively.

But, as our analysis also shows, most utilities are at the earliest stages in developing an integration solution. Our survey respondents have clearly identified the business change implications as the biggest challenge to successful IT/OT deployment. A sound business change approach must be put in place so that new capabilities are effectively supported and benefits realized. A fundamental concern is that the analytics capabilities—an essential component for IT/OT integration benefits capture—are fit for purpose. Our analysis suggests that not only do most utilities foresee the need for significant improvements across the breadth of analytics areas, but that the requirement for such improvements has increased dramatically in recent years.

For distribution utilities, IT/OT integration is a necessity, not a choice. Utilities need to grasp the implications for their organization, systems and skills as a priority.
The core deployment components essential for effective IT/OT integration

**Value driven by business strategy**
- Put the customer first in the discussion. How can we deliver more value to customers via IT/OT convergence in our operations?
- Define a multi-stage IT/OT convergence strategy as part of the broader smart grid strategy
- Define stages of business capability maturity and operating model evolution
- Ensure that any point solutions or proof of concepts are aligned to the overall business and system strategy

**Integrated governance structure**
- Develop an integrated governance structure blending together IT and OT governance
- Build support from both business and IT stakeholders for the value of the integrated IT/OT vision
- Increasingly, the overall governance mindset should be focused on delivering IT/OT integration benefits as opposed to delivering separate IT or OT benefits with the convergence as a lower priority

**Intentional convergence approach**
- Build an intentional IT/OT convergence zone into large technology delivery programs. The IT/OT convergence zone should have accountability and resources for the primary areas where IT and OT solutions need to connect (e.g., architecture, security, integration, data, etc.)
- Cultural convergence
  - Co-location of teams
  - Change agents—find or develop people with strong understanding of both IT and OT, facilitate communication between business and operations
- Process convergence
  - Streamlined processes, integration of traditional IT processes (device management, upgrade processes, etc.) into OT devices
  - New decision-making governance to ensure insights are effectively translated into action
- Technical convergence
  - Progressive evolution of data availability, granularity and quality to support key capabilities

**Organization-wide change management**
- Senior executive-led communication—part of a larger business transformation not a new system
- Develop and retain resources with a blended skillset covering IT and OT
- Develop data scientist / analytic skills that support the IT/OT integration

**Cybersecurity integrated into all design and operations**
- Build cyber-attack resilience into the systems and the process design up front
  - Leverage increased visibility from IT/OT convergence to improve network monitoring for cyber-attacks
About Accenture’s Digitally Enabled Grid research program

Accenture’s Digitally Enabled Grid research program provides actionable insights and recommendations around the challenges and opportunities utilities face along the path to a smarter grid. Drawing upon primary research insights from utilities executives around the world as well as Accenture analysis, the Digitally Enabled Grid research program examines how utilities executives expect smart grid technologies and solutions to contribute to their future networks.

About Accenture

Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions—underpinned by the world’s largest delivery network—Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With approximately 384,000 people serving clients in more than 120 countries, Accenture drives innovation to improve the way the world works and lives. Visit us at www.accenture.com.

References

1. Accenture 2016 Utilities executives survey: The role of IT/OT integration in enabling the future distribution network

About Accenture Smart Grid Services

Accenture Smart Grid Services focuses on delivering innovative business solutions supporting the modernization of electric, gas and water network infrastructures to improve capital efficiency and effectiveness, increase crew safety and productivity, optimize the operations of the grid and achieve the full value from advanced metering infrastructure data and capabilities. It includes four offering areas: Digital Asset Management, Digital Field Worker, Intelligent Grid Operations and Advanced Metering Operations.

Executive sponsorship

Stephanie Jamison
Managing Director
Accenture Smart Grid Services
Please contact: DEG@accenture.com

Follow us

@Accenture_Util
Accenture Utilities
Accenture Utilities

Visit us

For more information on Accenture’s services for utilities, visit us at http://www.accenture.com/utilities