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Big Data;

The buzzword of the day is 'analytics.' But what does it mean?

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Each year a big trend dominates the DistribuTECH trade show, becoming a word or phrase on the lips of exhibitors trying to attract interest on the show floor. Last year exhibitors wanted to talk about advanced distribution management systems, or ADMS. The year before, every product involved customer energy management systems. And the year before that, in-home displays were all the rage.

This year the deafening buzzword at DTECH was "analytics." Virtually every company at the show was talking about how their gadgets perform analytics for various purposes, and some companies were launching entire business products and practices focused on analytics.

At the same time, however, many conversations at DTECH indicated that the industry isn't exactly sure what analytics is supposed to accomplish--or even whether it involves anything fundamentally new.

For decades now, utilities have used logical data analysis methods to glean insights from historical data. That analysis depended on small samples of data, or was drawn from information entered by hand into basic relational databases. Now, as new smart grid systems come online, utilities are dealing with vastly larger amounts of data--which could potentially be used for much more sophisticated and detailed analysis than utilities ever performed before.

"Over the past few years, the struggle has been just to implement AMI and MDM. Utilities now have all this infrastructure and they're generating all this data," says John Wambaugh, senior vice president at UISOL--Utility Integration Solutions. "Internally they're saying, 'I've got to do something with it.'"

That "something" presents a remarkable challenge for many utilities. Will analytics allow companies to bring it all together--the advanced software platforms, enterprise architectures, interdepartmental portals, sophisticated algorithms, and the big data pouring out of high-tech equipment--to make major improvements across the enterprise? Is analytics the key to realizing the smart grid's promise?

After DTECH, *Fortnightly* followed up with executives at several companies that are leading the charge into analytics for utilities. As their comments suggest, the possibilities are enticing, but a future shaped by big data remains a somewhat blurry vision.

FORTNIGHTLY: What's your definition of analytics in the utilities context?

John Wambaugh, senior vice president, UISOL: Analytics is taking raw data to answer more complex questions. It can be very deep data just on a specific meter, analyzing that to discern useful information such as consumption patterns and trends, or it can be very broad data.

Michael Valocchi, vice president and partner, IBM Global Business Services: Analytics is optimizing operational, financial, and customer data to move the utility into being more of an insight-driven company, and being able to make decisions on a much more informed basis. We see it as much more than data.

Nick Hunn, CTO, Onzo: We look at analytics probably in the broadest sense. While everybody else is talking about big data and what they're doing, we've already got more than 1 trillion energy readings from customers [in Europe].

Jeff Meyers, smart grid strategy and development, Telvent: Data analytics could be defined as managing and presenting all network endpoint data in a way that makes it easier for the network owner to operate, plan, and optimize more efficiently from the utility side. More specifically than that, in our context, the distribution utility; we're interested in the medium-voltage and low-voltage grid.

Devendra Vishwakarma, T&D principal consultant, smart grid practice, Infosys: Depending on the level at which you're talking, everyone has a different definition of analytics. Analytics in the generic sense means energy trends, technology services, hardware processes that will enable us to make sense of data and turn it into actionable intelligence to make day-to-day decisions.

FORTNIGHTLY: How are analytics capabilities different now from what they were for utilities in the past?

Wambaugh, UISOL: Utilities have been doing analytics since spreadsheets. Load a bunch of data into a spreadsheet, use some of the tools and, boom! You have analytics.

Valocchi, IBM: It's true that data and analytics aren't new terms in the industry, especially data. We've always had a number of operational types of data: plant statistics, transformer statistics, statistics around assets--like age and condition.

Meyers, Telvent: Traditionally, getting energy usage information into the network-modeling context has been very labor intensive. It's somebody sitting down and building every one of the rate classes. Then maybe we can get a spreadsheet that has some typical usage patterns for 100 people in each class and somehow force-feed that into the network models, recast that out, and make assumptions about the typical customer.

[SEE PICTURE 1 IN ORIGINAL]

Bill Devereaux, vice president, industry strategy, Oracle: The utility industry is going through a transformation right now in terms of moving the management of operations--both customer and distribution operations--to a context where more of the decision making and analysis is based on true data coming from the field through sensors and various communications techniques.

Curt Puckett, senior vice president, sustainable use, KEMA: I was hired by Consumers Energy 33 years ago to participate in what were called 'controlled service experiments.' We were controlling residential air conditioners and small commercial air conditioners, putting in heat storage in residences, controlling residential water heating, and running time-of-use rate experiments. A lot of the stuff we talk about being new these days is just retreaded. The marvelous thing, of course, is that technology didn't stand still.

FORTNIGHTLY: What kinds of new data do utilities have to access now?

Bill Lewis, global alliance manager, utilities, Infosys: This explosion in interest in analytics has arisen out of the massive amounts of volume, the 'big data' as people are referring to it, coming from the smart metering systems and the

sensors in the grid.

Puckett, KEMA: The [quantity of] data that flows now is orders of magnitude larger than the data that flowed before.

Valocchi, IBM: The difference that I see today is the data is more real-time and much more granular than it's ever been.

Anjul Bhambhri, vice president, big data products, IBM: Utilities are seeing a very large amount of valuable data that allows them to look at operational analytics as well as predictive analytics for strategic planning.

Devereaux, Oracle: As engineers, for the first time you have comprehensive data about the distribution operations all the way to the customer endpoint.

Hunn, Onzo: With smart metering coming in, where you're getting regular data back, you can find out much more. Not only can you start to look at how customers use energy and how you engage with them, but it also gives you a far better idea of how you can optimize your network.

Meyers, Telvent: We're not so interested in the incremental reads in every meter in the network, but we are interested in some subset of that from a planning and optimization perspective. We're also interested in anomalies--those network performance parameters for voltage that are outside a certain range.

Devereaux, Oracle: The data is coming from all sorts of disparate places in different formats and in different structures from different vendors. That's your first thing to sort out as a utility.

FORTNIGHTLY: What does the latest analytics technology allow utilities to do now?

Linda Jackman, vice president, industry strategy, Oracle: You now have the ability to form this concept of 'federated' data. You might pull data in from an operational system serving inspection records around a utility's transformer, for example. There might be some unstructured data or time-series data coming in from the load, which you're getting from interval meters. You overlay weather data and actually mash all that data up.

[SEE PICTURE 2 IN ORIGINAL]

Wambaugh, UISOL: Very quickly one of the things you find out using analytics is where standards aren't being applied. I was just talking to a utility CIO who said he found out that in one area they were sending five people, and in another area they were only sending two people. So, apply a standard, you now send two people rather than five.

Devereaux, Oracle: In the past, identifying and ferreting out theft of service was largely based on field observations from either meter readers or other field technicians, or some gross look at usage pattern change. With AMI technologies, you can almost see on a real-time basis when a customer tampers with a meter.

[SEE PICTURE 3 IN ORIGINAL]

Wambaugh, UISOL: You can go very deep into analytics. A coworker suggested that analytics could identify outages that have the opportunity for cost recovery--an outage that occurred because somebody ran into a pole. Fixing that shouldn't be on ratepayers or shareholders. The cost should be borne somewhere else, like insurance claims.

FORTNIGHTLY: What can analytics do for T&D?

Devereaux, Oracle: Traditionally, you might have a periodic inspection process once every five years to check for gross-level failures, but in general you ran a distribution asset down to failure. Now I can create a predictive or proactive maintenance program around transformers that need attention. When I can address those issues ahead of time, I can prevent outages that otherwise would have occurred.

Lewis, Infosys: We're definitely seeing in condition-based maintenance, applying analytics so that you can do maintenance on a condition basis rather than on a schedule basis.

Hunn, Onzo: Some companies, like DataRaker, are doing quite nice analytics on smart meter data, helping to see transformers that are overly stressed within the network.

Meyers, Telvent: The more times we switch, the more times we cycle, the more we have an impact on asset life. We have to have a balance. That's kind of a new frontier. Data analytics are going to help us find that balance.

Valocchi, IBM: You're seeing more smart devices out in the field. Whether they're smart phones or smart tablets, [field workers can use them to] get to analytical information: the age of the asset, condition of the asset, things that have gone wrong on similar types of assets, and predictive analytics.

Devereaux, Oracle: The success of advanced distribution management is really about data and the accuracy of the network model, and the ability for you to trust the data that's coming in from the different input systems. You build that trust and the sense of confidence in those models to some degree through analytics.

Wambaugh, UISOL: Very quickly I know exactly what my return on investment is going to be, as opposed to previous years when you didn't have all the information. You just took a guess. You can do queries such as, what's the cost to establish a new service in my different service areas? Why am I seeing it cost three times as much in this area versus this other area?'

Lewis, Infosys: A guy named Bill Mann at DistribuTECH was talking about knowing types of trees. Pine trees are more likely to fall over in a wind storm than oak trees are. All that data can be assembled, analyzed, and used to predict where the most likely failures might be within the system. That's a far-out example, but with all the tools that are becoming available, the far-out examples are going to become a reality.

[SEE PICTURE 4 IN ORIGINAL]

FORTNIGHTLY: Let's talk about analytics that help utilities on the customer side.

Lewis, Infosys: There's a whole set of things that can be done for the benefit of the consumer by applying analytics. We're seeing utilities expressing interest in using analytics to predict situations that will cause customer issues [such as outages] . If you know what's coming down the road, then you can prepare by having proactive customer alerts.

Valocchi, IBM: There could be billing disputes that come from customers. Using technology, you can show the lineage of data, to point to errors or proof [about whether the customer's bill correctly reflects] exact consumption.

[SEE PICTURE 5 IN ORIGINAL]

Puckett, KEMA: A house is made up of a bunch of end uses, and it's consumers' behavior that makes us all unique. You and I could have the same kind of house and could have completely different energy profiles because of our own unique characteristics.

Hunn, Onzo: We've developed a range of clip-on sensors and energy displays that customers can self-install. We're starting to put in new sets of algorithms to look at how efficient your appliances are. If we see consumption going up from a fridge, it's probably an indication that the compressor isn't working or the seals on the door are starting to fail. We can give maintenance information back to consumers.

FORTNIGHTLY: What customer privacy issues arise from analytics, and how will utilities address them?

Hunn, Onzo: We've got Web interfaces we're just rolling out. You can actually pick out which [loads] were the

washing machines. There's obviously privacy issues, but all this we've done with people opting in to provide their data.

Puckett, KEMA: We're hired as a third party, independent evaluation consultant. With a number of power distributors there's a real debate on what information they're willing to release even to a third-party evaluator. Can we get access to the information we need to do our job, or do we need sign-off on a consumer level?

Hunn, Onzo: At conference in Australia, somebody rather glibly said that if utilities really understood the value of the data they could get from their customer, and they could actually exercise that value, they could give the electricity away for free. I think that's way over the top, but utilities are holding onto data that they're not doing anything with because they're afraid of letting anyone else have it.

Puckett, KEMA: We can usually can get hourly load records pretty readily, but now when you start talking about tying it with other intelligence about that home, it becomes a much more precarious situation. There is real concern about customer confidentiality, customer security. Those are going to be key aspects that have to be protected.

FORTNIGHTLY: What are specific examples of utilities that are using analytics in advanced ways today?

Devereaux, Oracle: Australia has some very tight rules around allowable voltages in the secondary system. We have a client in Australia who has been very progressive on transformer maintenance and using AMI data in a graphical way to understand where they have distribution system issues, and building maintenance programs around that.

Bhambhri, IBM: One of our customers, Vestas, a wind turbine company in Denmark, wanted to model the weather data to optimize the placement of turbines for maximum power generation. They told us that if we were to replay all the data that Vestas' wind library captured, we would be sitting down to watch 70 years of TV in high definition. We were able to analyze the data, flattening the analysis from three weeks to three days. This is a huge advantage to them because the more accurately they place the wind turbines, the more the output.

[SEE PICTURE 6 IN ORIGINAL]

Meyers, Telvent: Progress Energy in the Carolinas has something like 55,000 devices outside the substation fence. We're using real-time and near-real-time tools right now, getting all the information we can to dial the network in, especially under peak load, so at times we can reduce voltage and optimize reactive power to reduce peak load. There's a good example of having to digest a whole lot of information to do that.

[SEE PICTURE 7 IN ORIGINAL]

FORTNIGHTLY: Why are there so few end-to-end utility case studies in North America involving advanced analytics?

Valocchi, IBM: The fact is you've got some pretty strong barriers from a legal perspective, with codes of conduct around information that can be shared between a transmission operator and an end user. While we've got so much opportunity around the analytics and optimization, we're struggling with this new business model.

Devereaux, Oracle: There's a lot of uncertainty at utilities because of their concern about the size and scale of the data. Part of what we're trying to do is help them see that this is completely possible. It is and has been done at this scale of data in other industries, such as telecommunications or financial services.

Wambaugh, UISOL: I travel all the time and I've now had my credit card number stolen about four times. I'm amazed: I get a call from Visa saying, 'We detected a strange pattern.' It's within a day.

Vishwakarma, Infosys: When you talk about the advanced smart grid uses, you're talking about going more toward real-time operational analytics. There aren't many parallels that you can derive out of other segments of other industries.

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Let's talk about the travel industry. If your prices on the travel portal aren't up to the mark, nobody is going to blink. Utilities deal with mission-critical, real-time systems.

Wambaugh, UISOL: One of the things people need to realize about analytics is it's only useful if you know what kind of question you want to ask. If you don't know what question you want to ask and what answer you're seeking, then all you have is a whole bunch of data and some very expensive hardware, algorithms, and applications that are waiting for you.

Hunn, Onzo: I got the feeling at DistribuTECH that it's an industry at a moment of reflection; it's poured a lot of money out of the stimulus program and is looking back to say, 'What good did that do?'

Jackman, Oracle: Some utilities understand it and get it, and there are other utilities that are still very much at the infancy.

FORTNIGHTLY: An analytics term we hear a lot is 'cloud solutions.' What will that mean for utilities?

Hunn, Onzo: The cloud basically means I'm not going to install a server in your place but I'm going to do it on someone else's server. Going to the cloud is asking a utility to have confidence that data can be taken and analyzed outside the secure four walls of a utility. That's a big change.

Wambaugh, UISOL: One of the nice things about that is you can give me your data in an unstructured manner and it runs through unstructured tools to give you new ways to build quick and easy data analytics applications, to mine through that information and give you results in real-time. These are more real-time than batch-oriented, where you'd put all the data in, figure out what question to ask, crunch it for three days, and come out with a report.

[SEE PICTURE 8 IN ORIGINAL]

Hunn, Onzo: We do all the heavy number crunching on some servers out in the cloud, and feed the process data back to the home. It means we get economies of scale so you can have quite cheap hardware within your home, and we then do the data processing somewhere else. [So] we have to give utilities the comfort to know that they can be confident to work with us.

Puckett, KEMA: The release of individual customer data on how they use energy on a time-differentiated basis may be something that takes a while to get up to that cloud. It may require a release from the consumer.

A company called CEIVA at DistribuTECH was promoting the 'Internet cloud picture frame,' which I thought was pretty clever. Not only did you get your energy information stream, but it also gave you pictures of the grandkids and all that other fun stuff. It was trying to engage the consumer and say, look, we're not going to bore you with energy information but it will be periodically delivered.

[SEE PICTURE 9 IN ORIGINAL]

FORTNIGHTLY: How do analytics techniques translate into differences at the operational level? Do analytics lead to more dashboards, or can existing processes integrate analytics?

Bhambhri, IBM: Dashboards are there and they're going to continue to be there, but the analytic output in these dashboards is changing from a rearview-mirror focus to an actionable analytic focus.

Valocchi, IBM: Static dashboards are a thing of the past. The things we call dashboards don't feel like dashboards anymore. They're portals into different parts of processes.

Jackman, Oracle: Dashboards are a way of presenting data to the end user. But what it's about is embedding the

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information that the data is giving you and making operational improvements.

Lewis, Infosys: Essentially the dashboards are the top-level view of what's underneath within the enterprise. Once you define what you want to see in a dashboard, then you can start defining which systems underneath have to provide data, and which analytics are required in order to massage that data and present it in a form that's easy to digest by the executives.

Meyers, Telvent: The genius will be if we can get it simple enough and get the important things available and in the front of the queue so that the people who are actually operating the network in real-time or near real-time can understand them.

FORTNIGHTLY: Frequently people talk about how utilities are fragmented into different 'silos' that don't work well together. How does that factor into the potential for analytics to improve operations across the enterprise?

Lewis, Infosys: In order to get maximum benefit from analytics, you've got to bridge the silos.

Vishwakarma, Infosys: Traditionally when you go to utilities, they are afraid of sharing data with other departments, other organizations, because they know the data best.

Meyers, Telvent: Command and control networks have essentially stood alone. Whenever anyone wanted to interconnect with the SCADA network, the answer was no. But today we're trying to put that network into contact with enterprise networks and communications infrastructure and make it smarter, get more information in.

Wambaugh, UISOL: AMI and MDM have been one of the first technologies to break across that silo. You're starting to see it's become a real-time world, and everybody now has to get more real-time. It's also become an information-sharing world.

Vishwakarma, Infosys: Some of the data unification amongst these silos might not be possible due to regulatory reasons. For example, data from the reconciliation system for bills may not be shared with the power purchase department. The bigger problem is the willingness to share the data, because when you're talking about the unification of the information, and then when you create analytics, who owns the data?

Lewis, Infosys: The tools are there, which would typically fall under the domain of security: setting up the systems so the access privileges are clearly role-based, password protected, and so-forth. I wouldn't say it's simple, but today it's a lot easier than it has been before.

Jackman, Oracle: One of the mistakes people make is thinking that people have no data ownership. Everybody still owns the data they own, but with the assistance of the IT folks, data governance sits above and [allows] an enterprise view so you can actually pull this data altogether. You don't need to have all of that data centralized.

Devereaux, Oracle: It might not physically be one massive centralized database, but it is a single enterprise data model for the operations, from customer all the way through distribution and other pieces of the business. Everyone contributes, and everyone also has access to that full enterprise view of the data, so that they can do analysis now that they never would have been able to do because of organizational barriers.

FORTNIGHTLY: How will analytics be important in dealing with factors like renewable energy sources and electric vehicles?

Meyers, Telvent: In Ontario we're starting to integrate small wind turbines into the network--a few this year and a couple hundred next year, and maybe 500 the year after. Five years from now, if everything works right, they'll probably have enough that it will really have an impact on the grid.

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Jackman, Oracle: The mashup of customer data with transformer data here in the U.S. is going to be a major factor when you start looking at the rollout of electrical vehicles. If electric vehicles take off at a pace, the sizing of transformers will change quite dramatically. Fast chargers draw the equivalent of a house.

Vishwakarma, Infosys: With plug-in hybrids, you absolutely have to use data and analytics to figure out the optimum charging program for a neighborhood or a wider geography.

FORTNIGHTLY: When incomes to analytics, what are the biggest concerns for utilities?

Hunn, Onzo: I think the nature of the fear is just the sheer volume of data. It's a bit like a child that was allowed one Mars bar to eat per year, and then taking them into a WalMart and showing them the sweets section, and saying, 'You can live in here.'

Puckett, KEMA: I still work with a client that has customer-read meters. One has to appreciate the utilities that are on the bleeding edge of this technology.

Wambaugh, UISOL: You have to change the business, you have to change some of your standard processes, and you have to change how you think about things. That doesn't happen overnight.

Vishwakarma, Infosys: The CIM [common information model] for distribution is going to touch upon asset management, customer information systems, real-time systems, and all the silos. But utilities aren't ready to implement those because some standards are under-developed, some are fully developed, and some are being developed. You need to correlate information across the systems.

Meyers, Telvent: We had better take our architecture and our interoperability standards seriously so that the system can grow and adapt as the requirements grow and adapt.

FORTNIGHTLY: Looking out five or 10 years into the future, where will utilities be with analytics?

Puckett, KEMA: Analytics will help the consumer enable his house to respond to the proper signaling provided by the utility.

Devereaux, Oracle: I know from experience that we were learning every month new things we could do with the data coming off of our millions of meters. We're very bullish that this data is going to have a significant impact on the general forecasting functions that a utility does.

Meyers, Telvent: It's the thing we're thinking about now that will have the game finally changed five years from now.

Wambaugh, UISOL: We'll get even more into what's called complex event processing: real-time analytics where the data flows through these systems and the answers come out. I don't think analytics will be an afterthought. It will be part of the process, part of everything you do.

Valocchi, IBM: We're going to see a much more consumer-friendly utility in the future.

Jackman, Oracle: Once they raise their head above the parapet, after they've rolled out their meters and have actually started collecting more than a sample size of interval data, utilities will innovate--the same way as when you call up your bank and your bank knows exactly who you are, and what offers they can give you.

Hunn, Onzo: At heart, utilities like doing what they do today, which is supplying electricity and gas. And though I think we may see some pushing out into doing demand response and trying to sell other services, we will probably see more innovative services coming up, working alongside utilities.

Bhambhri, IBM: This is a pretty exciting time for this industry to really embrace the technology. The technology is

there. They have the data. Now they have to take the next step.

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GRAPHIC: Picture 1, "Analytics is about more than data. It's about being able to make decisions on a much more informed basis.", Picture 2, "The output in dashboards is changing from a rearview-mirror focus to an actionable analytic focus.", Picture 3, "The genius will be if we can get it simple enough and bring the important things to the front of the queue for the people who are operating the network.", Picture 4, "Utilities are holding onto data and not doing anything with it because they're afraid of letting anyone else have it.", Picture 5, "In order to get maximum benefit from analytics, you've got to bridge the silos.", Picture 6, "With a number of power distributors, there's a real debate about what information they're willing to release even to a third-party evaluator.", Picture 7, "The mashup of customer data with transformer data here in the U.S. is going to be a major factor when you start looking at the rollout of electrical vehicles.", Picture 8, "The common information model for distribution will touch upon asset management, customer information systems, real-time systems, and all the silos.", Picture 9, "I don't think analytics will be an afterthought. It will be part of the process, part of everything you do."