

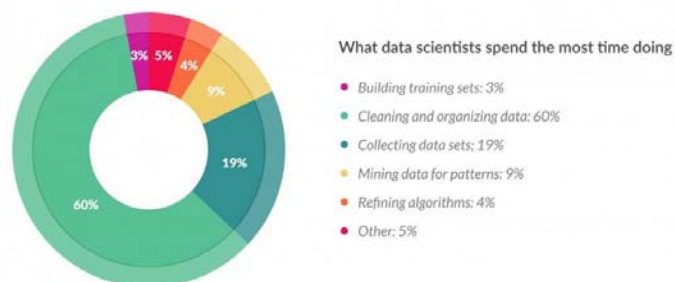
# Integrating and trending USM, Flow Computer, and Chromatograph diagnostics to identify measurement problems

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In order to understand ultrasonic meter and measurement diagnostics in general, we will need to know some facts about data and how the Oil and Gas Industry is handling technology. Today's technology requires that we must account for all of the information being pushed our way. Whether it is our refrigerator, the home security alarm, or the average television/smart phone, all of these individual pieces of equipment are constantly bombarding us with new information. This information collects over time forming tendencies and trends that, in time, essentially results in what we know as Big DATA. Can you imagine if the average homeowner or apartment dweller had to somehow warehouse *and* observe all of that data, and THEN make their decisions based upon what the data was telling them?! That would be a full-time job in itself.

Well, that is what we are facing as an industry, nation, and global economy. So, to make it easier to understand, let's break it down into more comprehensive information. We will start with Big DATA. I mentioned that already, but it seems to be the latest in buzz words these days. But, what does 'Big Data' mean exactly? Big DATA: 'extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.' Because of the amount, time, and expense, much of our IT investment is going towards managing and maintaining big data today.



## 60% of our IT time is going to cleaning Big Data Alone

With the IoT, Internet of Things, making such an influential mark on our marketplace, we are seeing more and more instrumentation, with more and more diagnostics, which means more and more data. While your smart home, fitbit, and Amazon Echo are beaming up the information to the cloud, we in the Oil and Gas Industry, are slow to move or even adopt the broader picture of how it all fits together. The IoT train is leaving the station and we must get on board or we will get left in the dust.

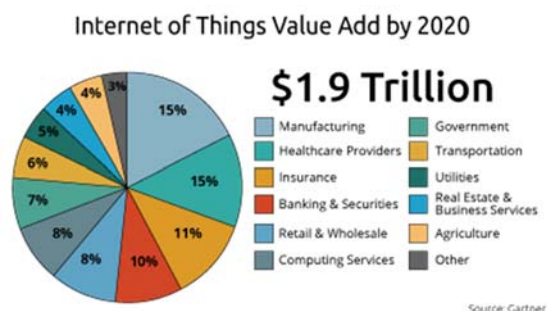
Next, let's explore the Internet of Things to give us a better understanding of how this all plays out. BusinessInsider.com explains the Internet of Things as the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. Thermostats, cars, lights, refrigerators, and more appliances can all be connected to the IoT.

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By the year 2018 more than 20% of all business will be authored by machines. We are looking at an age of technology where analytics are a driving force in the decisions we make and the results we produce. By the year 2020 most represented industries will have some sort of Big Data connected to the Internet of Things. Fortunately, for us as an industry, we can take advantage of the infrastructure of said IoT to improve our practices in the Oil and Gas Industry.



**The number of objects connected to the IoT exceeds the number of people in the world.**

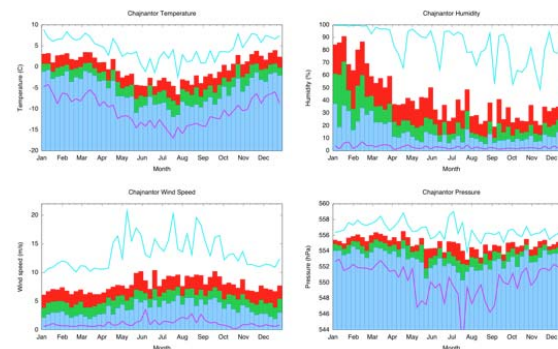
Analytics, or the systematic computational analysis of data or statistics is nothing new, in fact, we have been putting data together since the beginning of time. However, one of the shifts we are seeing with the collection of Big DATA is how analytics, patterns, and trends are managed.

So, what does that mean for our industry?

While Big DATA and analytics are being managed in all parts of our industry, we are still slow to adopt the technology. The fear of cloud storage is something that was and has been dealt with over the last several years. However, we remain hesitant. With the improvement and heightened awareness of cyber security the cloud has become less of an anomaly and more mainstream.

So, what are we doing? The different sectors that comprise our business use Big DATA in different ways. Such as Production, where they house equipment ratings, seismic vibrations, strata permeability, and thermal gradients. Midstream is more interested in streamlining their transport, distribution of oil and gas, and even analyzing economic conditions and weather patterns to forecast demand. This allows for better allocation of resources and optimal pricing.

## Weather Patterns and Analytics

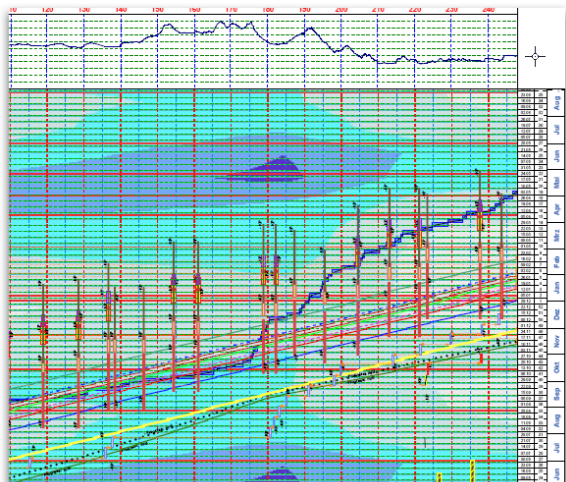


**Weather statistics (temperature, humidity, wind speed, and pressure) measured at the APEX weather station. This data has been collected over the years and is now being put to use for decision making.**

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**A meteorological map can be added so that the weather risk can be mitigated during the planning phase.**

And finally, Downstream is focusing on predictive analytics and model predictive control to continuously improve the overall performance of their facilities and more effectively maintain equipment. This proves to be challenging when one company is trying to service the needs of all industries in managing Big DATA.

With all of this talk of Big DATA and analytics we haven't even gotten to meter and instrumentation diagnostics for measurement purposes. I'll start at the beginning. With the introduction of Ultrasonic and Coriolis meters and the technology boom all around us we are now offered a plethora of diagnostics. This results in a case of the "I've got all of this data (Big DATA) and what am I going to do with it?"

The manufacturers have offered a solution along with their meters that allows the owner

of the meter to take a look at the data.

However, the problem with that being that there is so much more data that needs to be addressed in order to put in place healthy analytics to produce patterns and trends necessary to make more educated decisions.

In today's technologically savvy field measurement instrumentation, we are getting more data than ever before from every different direction. The question is...how? With Big DATA and everything being monitored and stored; we are creating data faster than our current technologies can store, process, or manage. Over 80% of the data we manage is considered unstructured data. Not only is our industry having difficulty in managing all of this data but for our measurement sectors, we need to find a way.

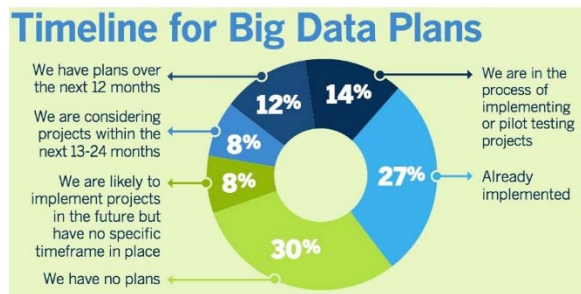
As an industry, we should be looking at smarter solutions to organize this data efficiently and effectively to optimize the measurement information that is coming in. Too many companies are just focused on managing the storage and not the data. This results in inefficiencies across the organization affecting measurement specialists, analysts, as well as IT. The average company will increase their data by 50% in the coming year. Overall the growth related to Big DATA will be upwards of 94%.

So, what is the answer for our measurement groups and the Oil and Gas industry as a whole? Bottom line...we need to be consistently analyzing our data. It is not going to slow down or stop. We need to get a handle on our efficiency in managing data, in order to allow our decision-making process to encompass even the most obscure trends for our collected Big Data.

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**58% of most companies' timeline is dedicated to getting there...**

Oil and Gas Engineering says; that in today's digital oilfield, most companies possess all of the data they need to improve operations within their historians. Many of these companies, however, continue to rely on traditional analytic tools such as spreadsheets to create actionable insight, which is becoming an increasingly expensive and time-consuming endeavor. As a result, much of the process historian data is not mined to create value.



**How much of YOUR TIME do you waste COLLECTING, REVIEWING AND VALIDATING DATA?**

When we look at our typical monthly on-site testing paradigm we see that it is labor intensive, risky and only a fraction of the information we need in order to make effective decisions.

The goal with monitored measurement diagnostics is to utilize the information to become more efficient and effective. If we are going to have and use big data, the likes of which we have no chance to escape from, we need to make it work for us. By breaking down the silos of departments and people, and allowing the information to flow more freely, we will be making more strategic decisions regarding our operations.

Take a typical meter run and all of the data that is associated with it. At any one point, you could be collecting up to 50 data points or more. You average that over 24 hours a day and 30 days in the month, you end up with more than 36,000 data points each month. That is big data! The implementation of more advanced technology in our industry has shifted the paradigm of managing this data to be much more efficient, and some are still lagging behind

In this new paradigm, you keep the same measurement team just breaking down the silos of 'non-shared information,' and reorganize the data so that it is stored in one place with one common goal.

In the next few steps we will be talking about the specific data that is collected from the various pieces of instrumentation. We will first look at the ultrasonic meter and all of it's diagnostics, the next step will be to pull in other instrumentation. The flow computer and the information gathered there is a crucial part the data organization. That allows you to look at flow rate in relation to the meter itself. The chromatograph and those individual diagnostics are an integral part in all of the data analysis as well. By pulling all of the quality information in we can form a more complete picture of what is happening in that meter run and ultimately

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inside the pipeline. Speed of sound is also something that the meter provides for analysis. When you have a third-party calculation, you can compare the Speed Of Sound from the meter to the calculated SOS for a second check. Lastly, Pressure and Temperature are always very important and if there is a redundant P&T, even better. The goal here is met. We have taken that huge mountain of data in different vehicles and different people manipulating it and made it more manageable by the reduction of data by 75% . The result is efficiency and effectiveness. We can put all of that information into 15 easy to use charts simply from the raw data that has been manipulated with analytics.

We have covered technology and where data collection is going. We have also covered the Oil and Gas Industry and how we might get this accomplished in a technical manner. But, one of the most important discussions is how this is going to affect and influence this industry (our measurement in particular) and probably most importantly, our risk overall. There are several risks that we face when discussing diagnostics data. Of the many, safety risk of employees on the road and at a station is almost always at the top of the risk management list. However, the risk of unnecessary measurement mistakes should take a noticeable second place.

As an industry, we tend to be risk averse and, therefore, apprehensive to move toward newer technology. Changing the paradigm for how we do things is not only difficult but unsettling. However, with the Information Age pushing the Oil and Gas Industry toward Big DATA; we are enthusiastically learning how to pare down our processes and rely on analytics, patterns, and trends gained from the diagnostics already out in the field. With that movement toward technology we find ourselves better prepared, more efficient, and ultimately much more effective.