"Is BIG DATA a Big Bust?" Our new add-on question is: Can a GIS-based "one version of the truth" goal meet all our big data related concerns?

Dr. Mani Vadari

November, 2014

Meet the Author:

An IEEE Fellow, electricity industry visionary, and leader, Dr. Mani Vadari delivers strategic services to a global set of utilities, vendors, and service providers seeking deep subject matter expertise in setting the business and technical direction to develop the next-generation electric/energy system. As a Business Architect, Dr. Vadari has been delivering solutions focusing on Transmission/ Distribution/ generation operations, Energy markets, and Smart Grid for over 35 years. In addition, he is an Adjunct Professor at Washington State University and an Affiliate Professor at the University of Washington. He has published two popular books, "Smart Grid Redefined: Transformation of the Electric Utility" and "Electric System Operations – Evolving to the Modern Grid, 2nd Edition", in addition to over a hundred industry papers, articles, and blogs. His books are serving as textbooks at several universities in the US and around the world

https://www.moderngridsolutions.com/

The utility Power System – the core system that an electric utility manages, is one of the strongest networks. For the most part, this network still functions based on the fundamental principles of physics as defined by Ohm's law, Maxwell's Equations, and a host of other similar principles and laws. Now, what does this actually mean? Among many other things, this means the following:

- *This is still a real-time network . Generation and load still need to be balanced on an instantaneous basis and the difference is demonstrated as a frequency deviation from the norm. This will probably stay until we see electric energy storage become a reasonably strong force both in capability and price.*
- *Power still flows where it is directed by physics and not directable by controls and valves. This may change in the future with the advent of Smart inverters, FACTS, and other similar devices which can alter the characteristics of a line forcing power to flow in the direction needed.*
- *Power consists of two components – real and reactive, one that converts to real energy and the other that is required to enable the flow of power from one location to the other.*
- *Transmission is still network-based and distribution is still radial for the most part in most parts of the world. This specific aspect drives the design of the grid all the way through switches, fault current calculations, relays/protection equipment, and their settings*

And there are many more.

So What? Why is this even Important?

This dependence on physics means that the flow of power from one place to the other depends on the physical characteristics of the grid – What are they?

·The type of component: This could be a switch, line, transformer or something else. Some of these are power systems in nature (as defined above) and others could be non-power systems in nature. The latter category includes components such as wood-poles, bus bars, cross-bars and so on. A third category of component is more of a grouping – an example of this is a substation.

- *Its name: What is it called?*
- *Its location: Where is this component located? This information tends to drive any distance-related component such as (transmission or distribution) line length and hence its resistance and so on.*
- *Its connectivity: Which components (if more than one) is this component connected to? This is important because it determines how the power will flow in the network.*
- *Its characteristics: In the case of a transmission line, what are its resistance, inductance, and so on?*

.

In addition, depending on the situation some of these change –

- *Characteristics – can change with temperature, season, and so on*
- *Connectivity – can change with the opening and closing of switches.*
- *And others.*

This brings an extra dimension to the discussion on “one version of the truth” – what is that?

The concept of “one version of the truth” in reality is more complicated that it appears. Let’s explain this based on some examples:
As-Designed Model: This is the designed model as defined by the planners and designers. This is where it all starts. Once the design is completed, this model is fixed.

As-Built Model: The crew that takes the design to the field for construction or modification may take field-level designs that will impact the actual implementation. Examples such as connecting the load to a different field transformer, connecting the load to a different phase, putting a pole at a different location, and so on. These changes will impact how the power flows from the source to consumption. Once the build is completed and the equipment energized, this model is fixed.

As-Operated Model: As switches open and close (either due to planned or unplanned operations), the connectivity changes, and as a result, the as-operated model changes. This is a dynamic model and will keep changing.

This means that there are several versions of the truth and the right one depends on what is being done with the model.

Now, let us come to Big Data and what we can do with it?

Utilities are gathering more and more data than ever in the past and this is coming from Smart Meters (multiple data points every 15 minutes or so), Distribution Automation (SCADA scan rates – 4-8 seconds per reading), and Synchro-phasors (multiple data points 30-60 times a second) and others. This is a lot more data than utilities have ever collected before and as more sensors get installed, the amount of data being collected will continue to increase even possibly exponentially.

One key point needs to be kept in mind about all of this data: They are not all in one place. Given that various custom systems collect the data; they are all stored in different places and most times in very different formats. Much of the data is dependent on the connectivity model of the system that existed at that time.

“Is BIG DATA a Big Bust?” Our new add-on question is: Can a GIS-based “one version of the truth” goal meet all our big data related concerns?

Dr. Mani Vadari

While the amount of data may not qualify it to be called Big Data, it is important to note that there is a lot of intelligence within this data that can be divided into five main categories.

- *Operational data*
- *Asset data*
- *Customer data*
- *Meter data*
- *Other assorted data*

So what can we conclude from this?

While some intelligence can be gained from the data itself, the smart move is in crossing the data between the categories identified above and correlating them to the “correct” version of the truth – which could be either the as-designed model, as-built model or the as-operated model. For this to happen, it is important to note that the appropriate version of truth is not only accurate, and up-to-date, but also available everywhere.

I believe that a well-maintained and accurate version of the truth is not just important but critical to (1) the proper functioning of the power system and (2) to derive good intelligence from the data.