



WAPAC The Brain of the Electric Power System

Smart Grid is the new "buzz" word that is exciting many people inside and outside of the electric power systems protection, automation and control industry. **The reason is that it goes all the way down** to the smart appliances in the "green" homes and the electric vehicles of the future.

THE SMART GRID OF THE FUTURE in the minds of many people is also smart meters. However, in reality, as I believe every protection, automation and control specialist understands, it is much more than that. If we make an analogy of the grid with a human being, the smart meters and appliances are the different sensors in our body – in skin, fingers, eyes, etc. They help us collect data about our environment. However, collecting data is not sufficient. We need to process the data and convert it into information that we can then use to build our "situation awareness". According to Endsley's definition (1995), situation awareness is "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future," that helps us survive in this world. In order to create the situation awareness, the human being uses the brain to convert the data into information that is further processed to evaluate the situation and determine what action (if any) needs to be taken. When necessary, we use our hands, arms, feet and whatever other tools we have to execute the required action.

Situation awareness has been a significant issue for many critical human activities, such as piloting a plane, fighting an enemy, etc.

Our industry has also started the process of implementing situation awareness concepts and developing tools to help the system operators in their job of controlling the electric power system and preventing local or wide area system disturbances. According to the definition from FERC's Smart Grid Policy "Wide-area situational awareness is the visual display of interconnection-wide system conditions in near real time at the reliability coordinator level and above". However, this cannot help during the critical moments following some system events that may lead to a wide area disturbance, simply because "near real time" is not good enough to prevent fast developing system events. Moreover, even if we have real time information, our reactions are too slow.

The time required by a person to respond to a visual, auditory or other stimulus is known as the reaction time and is the time required for an observer to respond to the presence of a stimulus. Many experiments performed by researchers have shown that the response time to simple events (light or sound stimulus) that require simple response (pressing a button) is in the range of 200 milliseconds. When the stimulus and the required response are more complex - the time increases,

making it clear that the operators cannot be asked to prevent a wide area disturbance. This is the job of the wide area protection, monitoring and control systems, the brains of the Smart Grid.

Writing this column reminded me of my driving instructor. He was a simple person, with the wisdom of a guru that has spent his life teaching many different people how to navigate and survive the crazy street traffic. From everything that he told me in the car, I mostly remember one thing – "Always look as far ahead of the car as you can see". He had no idea what the definition of situation awareness is, but he knew that in order to be ready to react to something that is ahead of you, you need to be aware of it as early as possible. The idea of seeing as far as possible is actually a very old concept. If you travel around the world you will see all the castles at a high point in the area. This was not done just to make it easier to defend them, but also to be able to see as far as possible.

This is the same concept that is included in many of the articles in this issue of the magazine. The authors describe different systems for wide area protection, monitoring and control based on hierarchical architecture with the decision making functions operating at the highest level of the hierarchy, seeing the data or information from as far as possible in the wide area they are designed to monitor and protect. ■

"Years ago, I discovered that by looking at the position from a distance, I got a better understanding of the game."

*Tom Wiswell,
Grand Master and Unrestricted Checkers Champion*