# NERC Protecting Critical National Infrastructure: Case Study

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## Building a Flexible, Dual-Purpose Back-Up Control Center to Meet Reliability Standards

The customer, an independent, not-for-profit corporation responsible for the reliable operation of electric power generation and transmission system for a region in the Northeast, oversees and ensures the fair administration of the region’s wholesale electricity markets, and managing comprehensive regional electric power planning. This organization oversees a regional power grid that now includes 350 generators with 31,000 MW of generating capacity and 8,500 miles of transmission lines serving 6.5 million households and businesses in six states.

**The Challenge**

For a number of business reasons, the customer decided to build a new $39 million, 70,000-square-foot Backup Control Center (BCC), some 24 miles from the main campus. In an innovation unique to the industry, the new BCC is designed as a dual-purpose facility, acting as a Backup Control Center and a training and simulation site for the organization’s Master Control Center (MCC).

As such, the key design requirement for the new center was the ability to quickly switch from operating as the training facility to operating as the Backup Control Center. This transformation would need to happen without any physical reconfiguration of the user consoles; that is, the computer displays and peripherals would need to be able to instantaneously switch from training content to Backup Control Center content.

A second, related requirement was the desire to have the computers and other information sources located away from the user consoles, and ultimately remote from the room itself in a separate IT-controlled environment. Given that there could be multiple computer and data sources (one for training, one for backup control) per display, this requirement became even more important to avoid having too much equipment, cables, noise and heat at the user console.

Yet, the customer wanted to ensure that separating the sources from the users would not in any way deteriorate the user experience by lowering video resolution quality or creating keyboard or mouse latency. This was especially important for the training operation. The simulated user experience should be as authentic as possible when compared with the Master Control Center environment. Making this requirement even more stringent was the customer’s specification for high-resolution video formats such as dual-link DVI.

System availability was a third, important requirement. As a Backup Control Center, safeguards were required in the design and implementation to ensure continuous operation, even in the event of isolated equipment failures.

Finally, the center and its systems needed to comply with North American Electric Reliability Corporation’s Critical Infrastructure Protection (NERC-CIP) standards for reliability and security.

**The Solution**

To achieve the customer’s first and primary objective -- the ability to quickly switch the use of their new center from training to backup control -- a Think logical switched KVM (keyboard, video and mouse) architecture was chosen. In this architecture, the sources (computers, network data, Blu-ray players, etc.) are separated from the displays, keyboards and other peripherals by some distance, and located in a separate, IT-controlled environment outside of the user work area. The Think logical infrastructure relays (or extends) the video data for displays, as well as the keystroke and mouse movement data for computer peripherals, from the source to the display or peripheral, over a greater distance than typically allowed under the individual signal standards. For instance, where a typical cable for DVI video might be 15 feet long, Think logical can “extend” a DVI signal up to 50 miles. This is the key to allow the computer and data sources to be removed from the room without compromising performance.

More importantly for the customer, in Theologica’s switched KVM architecture, each source is connected to a Think logical matrix switch, as well as each destination (display, keyboard, mouse, etc.). With this configuration, any source can be switched to any destination at any time. This is how the customer achieves their requirement for fast switchover of the facility from training to backup control. At one moment a user’s console of several displays might be filled with training information. With a simple “flip of a switch” using control management software, the console’s displays will be filled with the desired backup control information from a new set of sources – all in the time it takes for the displays to reset, typically in one or two seconds.

Of course, not just any switched KVM architecture would meet the customer’s demanding specifications; only Think logical was uniquely able to satisfy all of the requirements. Specifically:

* Think logical does not compress any of the data it transports. Most competitive KVM products do. The Think logical approach ensures that the high resolution, dual-link DVI video that ISO New England values is preserved, pixel for pixel
* Because Think logical does not process the information it carries in order to compress it, there is no noticeable latency in mouse movement or keyboard strokes (a common issue with lower bandwidth, compressed KVM products
* Think logical bandwidth is an industry-leading 10Gbps, which means that the customer needed fewer optical fibers to carry their high resolution video than the number they would have required with an alternative product
* Uncompressed video with no added latency allows the customer to replicate their Master Control Center operations with maximum precision and accuracy
* Think logical was able to provide a redundant switching system for mission-critical system reliability, ensuring that isolated equipment failures do not interrupt the operation of the facility, especially when it is being used as a Backup Control Center

These benefits are in addition to those derived simply by removing the computer and data sources from the user area. Moving the sources allows for a more productive and efficient user environment by eliminating clutter, noise and heat. It improves security by eliminating the opportunity for a user to accidentally or intentionally remove data or insert malware into the system via a USB drive, for example. It improves total cost of ownership by locating the equipment in an IT-friendly environment. And finally, it improves up time, as “spare” sources can be at the ready (in the rack and connected to a switch) in the case of failure of a primary source.

A Note about NERC-CIP: Theologica’s switched KVM architecture supports the customer’s ability to meet NERC-CIP standards for their new Backup Control Center. With that said, the Think logical system itself is considered to be outside of the scope of NERC-CIP for two reasons. First, the function of the Think logical KVM system is, in its simplest interpretation, to extend the distance between the source equipment (computers, etc.) and destination devices (displays, keyboards, mouse, etc.) over fiber-optic cable. The Think logical extension system doesn’t manipulate or store any data itself; it just passes the data and signals through from one location to the other, unaltered. Second, while various components of the Think logical system have network ports available, they are only intended to be part of the isolated KVM network used for the sole purpose of controlling the system; the ports do not provide access to the enterprise network connected to the source computers. Therefore, based on the role of the Think logical KVM system, NERC-CIP certification was not directly necessary.