

A recent study¹ from Idaho National Labs (INL) conducted as part of the Light Water Reactor Sustainability (LWRS) Program, identifies practices and principles to support nuclear power plant Digital Instrumentation & Controls (DI&C) modernizations. One practice proposed was the use of a safety-qualified switching architecture, based on Keyboard-Video-Mouse (KVM) components, referred to as a **Display-Keybaord-Trackball (DKT)** architecture. The DKT architecture envisioned by the INL research provides for a flexible Human System Interface (HSI) solution for the Main Control Room (MCR) that achieves the benefits of:

- simplification of the control room layout
- improvement of the Human System Interface (HSI)
- cost reduction from fewer displays
- consolidation of operator functions

Thinklogical's robust KVM extension systems, combined with our powerful matrix switches, enables a DKT architecture that provides mission-critical environments with a highly-flexible AV and IT infrastructure for applications including:

- main and remote control rooms
- safety and non-safety systems
- training
- remote monitoring
- security and surveillance
- simulation and modeling

Thinklogical is actively evaluating the supply of nuclear safety-related equipment. Although currently supplying non-safety-related products to the nuclear industry, the following characteristics make Thinklogical uniquely qualified to provide a safety-related DKT:

High Availability and More Efficient Workflows: Thinklogical's hot swappable and modular components (power supplies, fans, input/output (I/O) cards) ensure immediate real-time access and fast replacement of mission critical computing resources located anywhere, across facilities and operations. Computing resources can be moved to a dedicated IT server room with signals extended up to 80 kilometers from source to destination, which allows for more flexible layout and display of plant information at remote locations (e.g., emergency response centers).

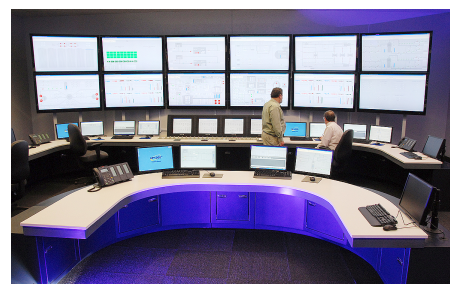
High Performance: Thinklogical offers the only Class 1E DKT that can deliver 100 percent uncompressed video images (pixel for pixel, no dropped frames or artifacts), including up to 4K/8K/UHD resolution. Video and content are seamlessly transported to the end user, providing them with detailed and immediate visibility to critical images and data. Keyboard, mouse, trackball and joystick performance is smooth and accurate with no added latency.

Security: Maintain compliance with the latest NERC-CIP cybersecurity requirements. Mitigating the threat from hackers and accidental breach while maintaining the efficient flow and distribution of video and data required for daily operations are key considerations in control room design. Thinklogical provides a highly-secure system infrastructure that does not store or buffer any data transmission in its products, circuitry or components, or allow user access to USB or network ports. Thinklogical's solutions are certified for use in secure facilities and support multi-domain isolation, partitioning and restricted switching for classified and unclassified information through one IA (information assurance) accredited system.

Maximum Up-Time: Thinklogical's secure Class 1E DKT system provides automatic fail-over at the system level. If an intentional disruption of the system occurs, it will immediately and automatically reestablish operation in a parallel system. The signals are received at two separate destinations, allowing one destination to be designated as a system fall-back, key to maintaining a 24/7 seamless operation. Alarms and remote monitoring are standard on every Thinklogical system.

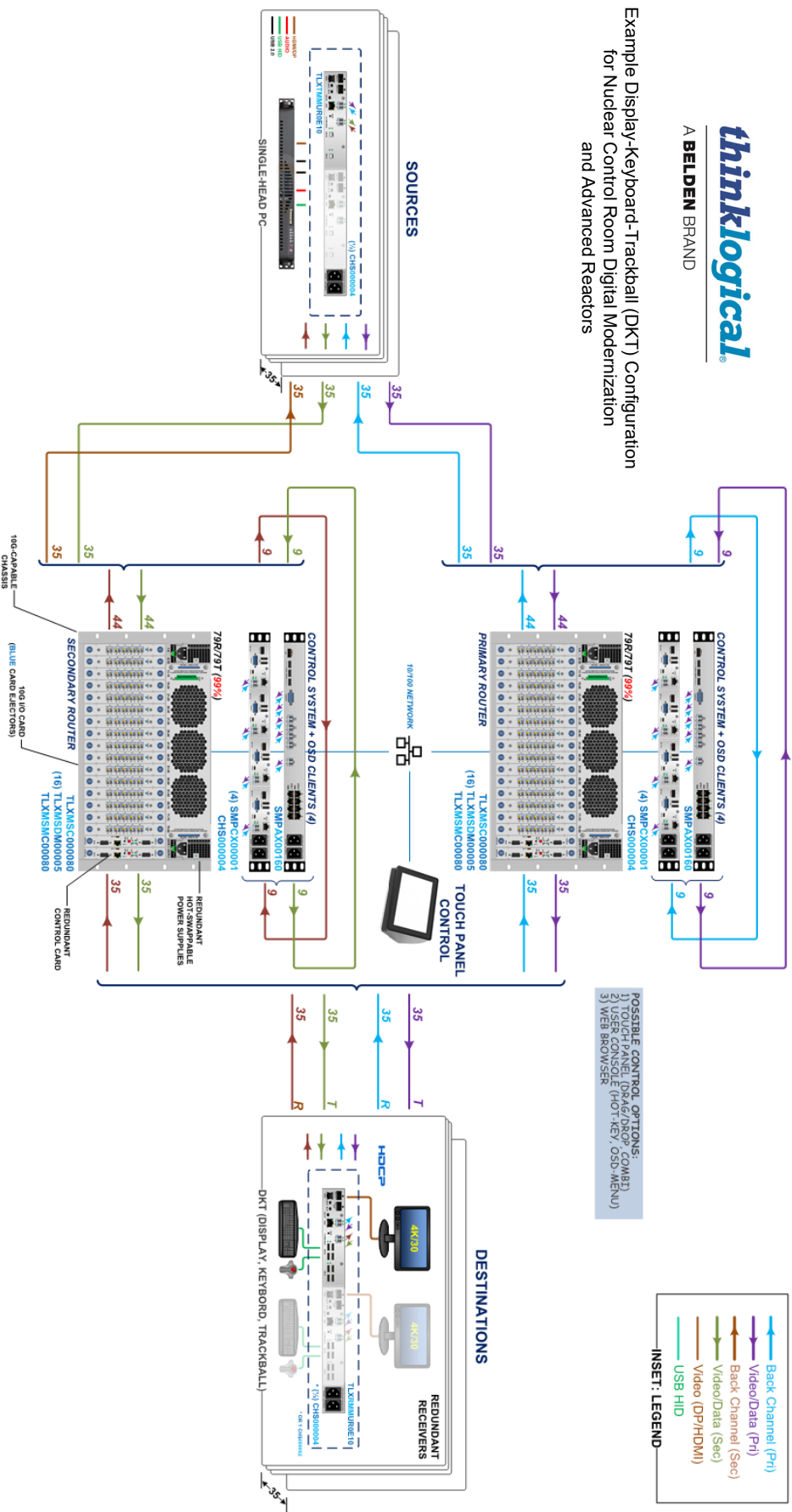
Contact Us for Your Next Control Room Project:

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¹ Hutton, Paul Joseph, & England, Robert T. Vendor-Independent Design Requirements for a Boiling Water Reactor Safety System Upgrade. United States. <https://doi.org/10.2172/1755891>

Example Display-Keybaord-Trackball (DKT) Configuration for Nuclear Control Room Digital Modernization and Advanced Reactors



- Solution shown features a fully redundant Display-Keybaord-Trackball "DKT" infrastructure. 35 single-screen PCs are connected to redundant matrix switches via diverse fiber optic cable paths. The diverse fiber paths then run to 35 operator workstations.
- The left side of the drawing shows source PCs connected to Thinklogical DKT (Display-Keybaord-Trackball) transmitters via standard copper cables. These cables are video, analog audio, keyboard, and trackball. The Thinklogical transmitter converts the electrical signal to an optical signal and distributes it via diverse fiber paths to duplicate, redundant Thinklogical matrix switches seen in the center of the drawing.
- Both matrix switches work synchronously, switching sources to destinations as requested by control system. In the event of a failure the "backup" switch becomes the primary. Each matrix switch is controlled by a dedicated control system. Both control systems are running synchronously.
- Fiber then runs from each matrix to each receiver. The optical signals are converted back to electrical at the Thinklogical receiver and distributed to the Display, Keyboard and Trackball (DKT) devices. Should any fiber path or matrix switch fail, the system automatically switches to the back up.
- Please note that sources can be any number of PCs (with any number of Displays) or data inputs and destinations (operator workstations) can handle any number of video displays from these multiple sources as required. The Thinklogical matrix switch is non-blocking, meaning any source can be displayed at multiple destinations simultaneously without technical restrictions. The control system is configured to allow source selection to destination switching by an operator only as allowed by the system administrator based on security or policy protocols.
- The Thinklogical transmitters, matrix switches and receivers all utilize N+1 redundant load sharing power supplies for reliability and resiliency.