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SCADA Systems and Critical Infrastructure Security

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The increasing integration and interconnectivity of critical infrastructure systems has created numerous cybersecurity risks for our nation's most vital systems; e.g., electric grids, water treatment plants, and transportation systems. Although Supervisory Control and Data Acquisition (SCADA) systems have introduced new vulnerabilities into critical infrastructure systems, the technology also offers tools to aid in the reduction of risk when implemented in accordance with secure guidelines.

Introduction

Critical infrastructure systems are a necessity for daily life as they support fundamental services such as electricity, water, and transportation. Due to the growing connection to modern computer networks, however, these critical systems also increase their susceptibility to cyber attacks. SCADA systems provide a means to monitor and control these critical infrastructure operations. Therefore, SCADA systems represent a central component of both the problem and the solution relative to protecting critical infrastructure.

Vulnerability in Critical Infrastructure Systems

One of the primary vulnerabilities inherent within critical infrastructure is unauthorized access. By exploiting inadequate security measures, hackers may obtain remote access to SCADA software and subsequently alter the operation of the affected systems. Threats include unauthorized system access and malware that may disrupt or compromise operational processes ("SCADA Systems").

Another significant threat is the openness of the network(s) that allow for communication among SCADA devices. While modern SCADA systems utilize web based communication protocols to enhance communication and efficiencies among devices, this openness also presents a number of opportunities for potential cyber threats. More recent versions of SCADA systems present greater vulnerabilities than previous versions, as they employ commonly used networking protocols ("SCADA Systems").

Thirdly, there exists a deficiency of robust security within communication protocols utilized by SCADA systems. In many instances, hackers may be able to communicate directly with SCADA devices via command signals as a result of inadequate security features. This represents a substantial risk, as devices can be remotely operated by unauthorized individuals ("SCADA Systems").

Finally, a large number of organizations are under the mistaken impression that SCADA systems cannot be compromised as a result of their physical isolation. As interconnectedness continues to evolve, this misconception will cease to exist. Both physical access points and network connections can be exploited. A practical illustration of these vulnerabilities was demonstrated during the Stuxnet attack against industrial control systems. According to the Cybersecurity and Infrastructure Security Agency, industrial control systems are frequently targeted as a result of their significance to national security ("Industrial Control Systems Security").

Reducing Risk through SCADA Systems

Although these vulnerabilities do exist, SCADA systems also provide methods to decrease risk. Two primary mechanisms to achieve this goal are real time monitoring and Human Machine Interface (HMI). Real time monitoring provides immediate feedback regarding device status and/or system malfunction. SCADA systems gather information from various types of sensors and/or devices that monitor operational status. Operators can immediately recognize anomalies associated with system behavior and act prior to issues escalating ("SCADA Systems").

An additional method that provides an advantage is the HMI. The HMI is a graphic representation of the operational conditions of a system. It allows operators to visually interpret the status of all components within the system, thereby enabling operators to quickly determine what actions need to be taken ("SCADA Systems").

Redundancy is another method provided by SCADA systems that enhances reliability. Many systems contain redundant servers and/or communication pathways. Redundant server pathways ensure continued operation of a system if one or more components fail ("SCADA Systems").

Modern SCADA systems also incorporate a number of security tools that include firewalls, Virtual Private Networks (VPNs), and application whitelisting. These tools provide an added layer of security to assist in preventing unauthorized access to a system, thus maintaining

system integrity ("SCADA Systems"). As noted in "Guide to Industrial Control Systems Security," utilizing layered security techniques such as network segmentation and access controls can substantially enhance the overall security posture of industrial control systems ("Guide to Industrial Control Systems Security") .

Risk vs. Security

While SCADA systems offer numerous advantages, they also require careful security management. The enhanced connectivity offered by modern SCADA systems results in improved performance; however, this increased connectivity also generates greater opportunity for exploitation. To adequately protect critical systems, organizations should implement layered security solutions employing multiple layers of defense such as monitoring, authentication and/or network protection. Reliance solely upon a singular form of protection is insufficient to safeguard critical systems.

Conclusion

Critical infrastructure systems are essential for everyday living; however, they are highly susceptible to cyber threats. SCADA systems are both sources of risk and mitigators of risk. When properly managed with respect to security best practices including monitoring, redundancy, and/or multiple layers of defense, SCADA systems can greatly enhance the safety and reliability of critical infrastructure systems.

Works Cited

“SCADA Systems.” *Tech-FAQ*, http://www.tech-faq.com/scada.html.

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