Modern Industrial Networking and Data Communications Training Course

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4100 € (Per Person)

Ref: #DM9459_272921

Course Introduction / Overview:

In the age of Industry 4.0 and the Industrial Internet of Things (IIoT), the backbone of any modern industrial operation is its data communication network. This course provides a comprehensive exploration of the principles, protocols, and practices essential for designing, implementing, and maintaining robust and secure industrial networks. We delve into the critical differences between IT and OT (Operational Technology) networking, ensuring participants understand the unique demands of real-time control and data acquisition systems. Drawing upon foundational concepts discussed by experts like Lawrence M. Thompson in works such as "Industrial Data Communications", this program moves from theory to practical application. Participants will gain hands-on insights into configuring Industrial Ethernet, managing protocols like Modbus TCP/IP and PROFINET, and securing critical SCADA systems against emerging cyber threats. BIG BEN Training Center has meticulously designed this curriculum to empower professionals with the skills needed to build resilient network infrastructures that enhance operational efficiency, improve safety, and drive innovation on the plant floor. This training is not just about understanding technology; it is about mastering the communication systems that power modern industry.

Target Audience / This training course is suitable for:

- Automation Engineers and Technicians.
- Control Systems Engineers.
- Instrumentation and Control Technicians.
- IT Professionals working with industrial networks.
- Plant Managers and Operations Supervisors.
- Maintenance and Reliability Engineers.
- Process Control Specialists.
- Network Engineers transitioning to industrial environments.

Target Sectors and Industries:

- Manufacturing and Assembly Plants.
- Oil and Gas Production and Refining.
- Power Generation and Utilities.
- Water and Wastewater Treatment Facilities.
- Pharmaceutical and Chemical Processing.
- Mining and Metals.
- Food and Beverage Production.
- Government and Public Sector Infrastructure.

Target Organizations Departments:

- Engineering and Design.
- Operations and Production.
- Maintenance and Reliability.
- Information Technology (IT) and OT Support.
- Process Control and Automation.
- Health, Safety, and Environment (HSE).
- Project Management.

Course Offerings:

By the end of this course, the participants will have able to:

- Differentiate between IT and OT network requirements and design principles.
- Analyze and select appropriate industrial network topologies and media.
- Configure and troubleshoot key industrial protocols such as Modbus TCP/IP, EtherNet/IP, and PROFINET.
- Design a segmented and secure industrial network architecture using VLANs and firewalls.
- Understand the communication architecture of SCADA and Distributed Control Systems (DCS).
- Implement basic cybersecurity measures to protect industrial control systems from common threats.
- Evaluate the role of IIoT protocols like OPC UA and MQTT in modern industrial data exchange.
- Develop effective strategies for industrial network monitoring, management, and troubleshooting.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, practical, and engaging, ensuring that participants not only learn the theory but can also apply it in real-world scenarios. This course utilizes a blended learning approach that combines expert-led instruction with hands-on exercises and collaborative problem-solving. Mornings will typically focus on foundational concepts, protocol specifications, and design principles, presented through clear and concise lectures supported by visual aids. Afternoons are dedicated to practical application, where participants will engage in simulated network configuration tasks, analyze case studies of industrial network failures, and work in teams to design network solutions for specific industrial challenges. Group discussions are a core component, encouraging the sharing of experiences and fostering a deeper understanding of the complexities of bridging the IT/OT gap. Our instructors facilitate a dynamic learning environment, providing continuous feedback and guiding participants through complex troubleshooting exercises. This immersive approach ensures that attendees leave with tangible skills and the confidence to manage and secure modern industrial communication networks effectively.

Course Agenda (Course Units):

Unit One: Foundations of Industrial Data Communications

- Introduction to Industrial Control Systems (ICS) and Operational Technology (OT).
- Comparing the OSI and TCP/IP models in an industrial context.
- Industrial network topologies including Ring, Star, and Bus.
- Transmission media: Twisted Pair, Coaxial, Fiber Optics, and Wireless.
- Understanding latency, jitter, and determinism in industrial networks.
- Introduction to Industrial Ethernet and its advantages.
- Noise, grounding, and shielding in industrial environments.

Unit Two: Core Industrial Communication Protocols

- Deep dive into the Modbus protocol family (RTU, ASCII, and TCP/IP).
- Exploring EtherNet/IP and the Common Industrial Protocol (CIP).
- Understanding PROFINET for real-time automation.
- Overview of classic Fieldbus technologies: PROFIBUS, Foundation Fieldbus, and HART.
- Protocol analysis and packet sniffing basics for industrial networks.
- Interoperability challenges and solutions between different protocols.
- Configuration of devices using various industrial protocols.

Unit Three: SCADA, DCS, and IIoT Integration

- Architecture of Supervisory Control and Data Acquisition (SCADA) systems.
- Communication protocols for the power industry: DNP3 and IEC 61850.
- Introduction to the Industrial Internet of Things (IIoT) and Industry 4.0.
- Understanding OPC UA (Unified Architecture) for platform-independent data exchange.
- Leveraging MQTT for lightweight IIoT messaging.
- Data acquisition strategies from PLCs, RTUs, and sensors.
- Integrating legacy systems with modern network architectures.

Unit Four: Industrial Network Design and Management

- Principles of hierarchical network design (Purdue Model).
- Network segmentation using VLANs and subnets for security and performance.
- Implementing network redundancy with protocols like RSTP and PRP.
- IP addressing strategies for industrial networks.
- Network management and monitoring using SNMP and other tools.
- Best practices for network documentation and asset management.
- Selection criteria for industrial-grade switches, routers, and firewalls.

Unit Five: Industrial Network Security and Troubleshooting

- The threat landscape for industrial control systems.
- Fundamentals of OT cybersecurity and the defense-in-depth strategy.
- Configuring firewalls and access control lists for industrial zones.
- Introduction to Intrusion Detection Systems (IDS) for OT networks.
- Systematic approaches to network troubleshooting.
- Using diagnostic tools to identify and resolve common network issues.
- Developing a basic incident response plan for a network outage or security breach.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As industrial networks converge with IT networks, how can organizations balance the need for data accessibility with the critical requirement for operational security and real-time performance?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by focusing on the practical convergence of Information Technology (IT) and Operational Technology (OT), a critical challenge in modern industry. Unlike programs that teach protocols in isolation, we emphasize a holistic, vendor-neutral approach to designing, securing, and troubleshooting the entire industrial communication ecosystem. Our curriculum is built around real-world case studies and problem-solving scenarios, moving beyond theoretical knowledge to impart the critical thinking skills needed to diagnose complex network failures under pressure. We dedicate significant time to the nuances of industrial cybersecurity, addressing the specific vulnerabilities of SCADA and PLC systems rather than applying generic IT security models. Furthermore, the course content is forward-looking, integrating essential IIoT protocols like OPC UA and MQTT, preparing participants not just for the networks of today, but for the interconnected smart factories of tomorrow. The emphasis is on building resilient, high-performance networks that are secure by design, providing a deeper, more applicable level of expertise than standard protocol-specific training.