EUROPEAN PATENT SPECIFICATION

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SECURE COMMUNICATIONS LAYER FOR INDUSTRIAL CONTROL SYSTEMS

Patent Holder: DeepShield Systems, Inc.

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TECHNICAL FIELD

[0001] The present invention relates to a secure communications architecture for industrial control systems (ICS), specifically concerning methods and systems for establishing encrypted data channels between operational technology (OT) devices while maintaining deterministic performance requirements for critical infrastructure environments.

BACKGROUND

[0002] Industrial control systems face increasing cybersecurity threats while requiring strict deterministic performance. Existing encryption methods often introduce latency that compromises real-time operations critical to industrial processes.

[0003] Prior art solutions fail to adequately address the unique requirements of OT networks, particularly in maintaining sub-millisecond response times while providing robust security against modern cyber threats.

SUMMARY OF INVENTION

[0004] The invention provides a novel secure communications layer that enables real-time encrypted data transmission between industrial control system components while maintaining deterministic performance characteristics essential for critical infrastructure operations.

DETAILED DESCRIPTION

1. System Architecture

[0005] The secure communications layer comprises:

a) A hardware-accelerated encryption module utilizing a proprietary implementation of AES-256-GCM optimized for industrial protocols;

b) A deterministic packet scheduling system ensuring consistent sub-100 microsecond latency;

c) An adaptive security policy engine that dynamically adjusts encryption parameters based on threat levels and performance requirements.

2. Key Technical Features

[0006] The invention implements:

1 Protocol-Aware Encryption

- Selective encryption of critical control messages
- Protocol-specific optimization for MODBUS, PROFINET, and EtherCAT
- Hardware-based protocol parsing and encryption

2 Deterministic Performance

- Guaranteed maximum latency of 100 microseconds
- Zero-copy memory architecture
- Priority-based packet scheduling

3 Security Features

- Perfect forward secrecy through dynamic key rotation
- Hardware-based random number generation
- Quantum-resistant key exchange protocols

CLAIMS

A method for secure industrial control system communications comprising:

a) Establishing encrypted channels between OT devices using hardware-accelerated encryption;

b) Maintaining deterministic performance with sub-100 microsecond latency;

c) Implementing protocol-aware selective encryption.

The method of claim 1, further comprising:

a) Dynamic adjustment of encryption parameters based on threat levels;

b) Hardware-based protocol parsing and encryption;

c) Zero-copy memory architecture for minimal latency.

TECHNICAL ADVANTAGES

[0007] The invention provides:

- 99.999% availability for critical communications
- Latency reduction of 85% compared to software-based encryption
- Zero impact on industrial process timing requirements
- Compliance with IEC 62443 security standards

INDUSTRIAL APPLICABILITY

[0008] The invention is particularly applicable to:

- Power generation and distribution systems
- Industrial automation networks
- Maritime control systems
- Critical infrastructure protection
- Manufacturing execution systems

PATENT FAMILY INFORMATION

Related Applications:

- US Patent Application No. 17/204,891
- PCT Application No. PCT/US2021/022456
- Chinese Patent Application No. CN202110287654.2

INVENTOR INFORMATION

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CERTIFICATION

I hereby certify that this patent specification accurately describes the invention as claimed and meets all requirements for European Patent Office filing and prosecution.

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