Cyberium

SOLUTION BRIEF

One-Way Hardware Enforced PI-to-PI Replication for Critical Infrastructures

Unbreakable Security
Zero Latency
Data & metadata Sync
Maximum Uptime

OWA-MICA

In partnership with:

AVEVA Partner Ecosystem | Independent Software Vendor | CERTIFIED

Executive Summary

Critical infrastructure operators face a fundamental dilemma: leveraging PI data for digital transformation while maintaining ironclad OT security. Traditional PI replication solutions force operators to choose between connectivity and security, often creating the very vulnerabilities that threat actors exploit.

Cyberium OWA-MICA eliminates this compromise:

Our hardware-enforced, one-way PI replication solution delivers real-time data synchronization from OT to IT environments while providing physical security guarantees that software solutions simply cannot match. **Built on native PI AF SDK technology and paired with Cyberium's proven one-way data diode architecture OWA, MICA** enables operators to unlock the full value of their PI Systems without exposing critical infrastructure to IT-borne cyber threats.

The result: Millions of tags replicated in real-time, zero attack surface from IT to OT, and operational costs reduced by up to 66%

THE CHALLENGE

OT/IT Integration Under Siege

The Operational Reality

Critical infrastructure operators rely on AVEVA PI Systems to aggregate millions of time-series data points from DCS/SCADA systems across multiple plants into centralized IT networks. This consolidated view powers analytics, business intelligence, and digital transformation initiatives essential for modern operations. However, this connectivity creates fundamentally **new challenges.**

Operational Complexity

- **Tag Conflicts**: Managing millions of tags across multiple OT sources leads to naming collisions and metadata misalignment
- **Synchronization Issues:** Traditional replication mechanisms struggle with latency, requiring frequent reboots and manual intervention
- **High Availability Demands:** Downtime for replication systems disrupts critical business analytics and reporting
- **Performance Bottlenecks:** IT PI servers strain under replication loads, particularly during backfill operations
- **Monitoring Blind Spots:** Limited visibility into replication health leads to undetected issues
- **License Cost Explosion:** Full PI Server licenses for IT replicas dramatically increase TCO

The Security Imperative

More critically, PI Systems have become prime targets for advanced persistent threats. **According to Dragos threat intelligence reports, CISA alerts, and MITRE ATT&CK for ICS (T0887 – Historian Compromise), attackers consistently target PI Data Archives as pivot points from IT networks into OT environments.**

Why PI Systems are targeted?

- Direct connectivity to DCS/SCADA systems on lower OT network levels
- Native two-way TCP/IP communication requirements
- Privileged access to critical process data
- Trusted position within the Purdue model architecture

The threat is real: Groups like ELECTRUM and XENOTIME have successfully compromised PI Systems to gain OT network access, modify process data, and disrupt operations.

Traditional replication solutions worsen this risk by maintaining two-way network connectivity between IT and OT — effectively creating attack paths that standards like IEC 62443, NIST, and NERC-CIP aim to eliminate.

THE SOLUTION

Cyberium OWA-MICA PI Replicator

Redefining Secure PI Replication

Cyberium OWA-MICA (One Way Appliance – Multi-Instance Continuous Availability) is a hardware-enforced, one-way PI replication solution purpose-built for critical infrastructure. Unlike software-based approaches or traditional replication methods, MICA provides unbreakable physical security while delivering enterprise-grade operational performance.

Three Components Design

1. **Cyberium OWA** (**O**ne-**W**ay **A**ppliance): Hardware data diode enforcing **strictly unidirectional** data flow at the physical layer—no firmware, no OS, no attack surface
2. **MICA Upstream Agent** (**OT** Side): Intelligent proxy that translates two-way PI protocols into one-way data transmission, eliminating any return paths
3. **MICA Downstream Agent** (**IT** Side): Receiving proxy that reconstructs PI data and sends them to IT PI Data Archives

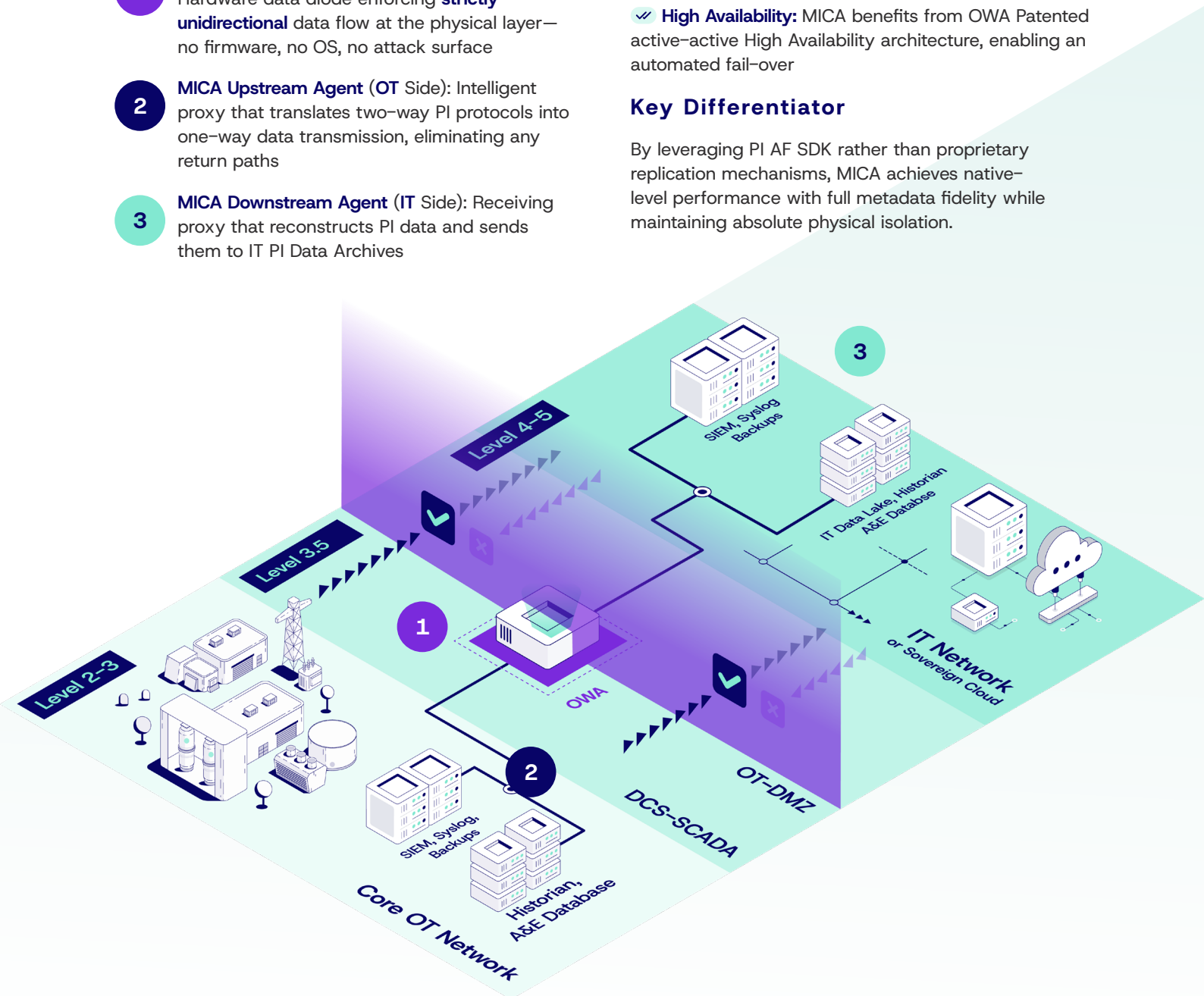
How It Works

MICA operates as a transparent replication layer between OT and IT PI Systems:

- **Data Capture:** Upstream MICA agent receives OT PI Tags values and meta-data
- **Protocol Translation:** Two-way PI protocols converted to unidirectional data streams
- **Physical Isolation:** Data passes through hardware-enforced one-way optical data diode
- **Reconstruction:** Downstream agent reconstructs PI data streams and writes to IT PI Archives
- **Continuous Synchronization:** Real-time tag updates, metadata changes, and digital sets maintained automatically Purdue model architecture
- **High Availability:** MICA benefits from OWA Patented active-active High Availability architecture, enabling an automated fail-over

Key Differentiator

By leveraging PI AF SDK rather than proprietary replication mechanisms, MICA achieves native-level performance with full metadata fidelity while maintaining absolute physical isolation.



Key benefits & proven results

Eliminate Metadata Conflicts & Tag Collisions

The Problem: Aligning digital sets, engineering units, and point attributes across hundreds of thousands of tags from multiple OT sources is nearly impossible with manual methods or basic replication tools.

MICA Solution:

- Real-time metadata replication using PI AF SDK
- Automatic conflict detection and prevention
- Protection against catastrophic archive overwrites
- Preserved data integrity across all tag attributes and flags

Result: One customer managing 2+ million tags eliminated metadata misalignment issues that previously required manual Excel-based reconciliation, preventing data corruption entirely.

Achieve True High Availability with zero Maintenance Windows

The Problem: Legacy replication solutions require periodic reboots, manual intervention during outages, and scheduled maintenance windows that disrupt analytics.

MICA Solution:

- Active-passive HA architecture with automatic failover
- Intelligent buffering survives extended IT outages (days of capacity)
- Automatic backfill and recovery without human intervention
- No scheduled maintenance required

Result: Production systems running continuously for multiple years without a single reboot. OT outages recovered automatically. IT downtime absorbed transparently with automatic catchup once services restored.

Eliminate Latency & Performance Bottlenecks

The Problem: Batch-based replication creates lag times measured in minutes, while aggressive polling overwhelms OT PI servers and networks.

MICA Solution:

- Event-driven replication delivers updates in seconds
- Optimized PI AF SDK utilization minimizes OT server load
- Intelligent backfill mechanisms prevent performance spikes
- Granular performance monitoring and alerting

Result: Sub-second latency for critical tag updates. Reduced load on OT PI Archives by eliminating inefficient polling patterns. IT analytics teams gained access to near-real-time data.

Deliver Comprehensive Monitoring and Operational Visibility

The Problem: Black-box replication may create operational blind spots. Issues go undetected until users report missing or stale data.

MICA Solution:

- Centralized web GUI for all replication streams
- Real-time visibility into PI Buffer subsystem health
- Proactive alerting via syslog and email
- Performance metrics, health dashboards, and audit trails
- Early warning detection before issues become critical

Result: Operations teams detected and resolved IT PI server performance issues before impacting users. Root cause analysis time reduced from days to minutes.

Reduce OPEX costs up to 66%

The Problem: Full PI Server licenses for IT replicas multiply costs. Complex replication solutions require expensive maintenance contracts and specialized staff.

MICA Solution:

- PI AF SDK-based replication enables read-only IT PI Archives
- Read-only servers require only ancillary licensing (1/3 of the cost)
- Elimination of scheduled maintenance reduces labor costs
- Self-healing design minimizes support requirements

Result: Customers reduced PI licensing costs by two-thirds while simultaneously improving reliability and security posture.

Drastically Harden OT-Security Posture

The Problem: Software-based solutions rely on firewall rules, network segmentation, and configuration management—all vulnerable to misconfiguration and exploit.

MICA Solution:

- Hardware-enforced one-way communication—physics-based security
- Eliminates entire attack surface from IT to OT
- Meets highest regulatory and industry standards
- Inherently compatible with Zero Trust security models

Result: Security audits confirm zero bidirectional network paths. Compliance with IEC 62443, NERC-CIP, and NIST frameworks. Threat model analysis shows complete mitigation of historian compromise attack vectors (MITRE ATT&CK T0887).

Why Cyberium OWA-MICA?

The Only Solution Delivering

Both Security AND Performance

- Most OT/IT integration solutions impose impossible tradeoffs:
- Air gaps eliminate real-time capacities and create a false sense of security. Batch replication creates an unnecessary burden on OT Pi servers
- Firewalls provide connectivity but maintain attack surfaces
- Software data diodes can be bypassed through firmware exploits
- Batch replication reduces real-time value of data
- Proprietary protocols limit scalability and increase complexity

Built by OT Security Experts, for OT Professionals

Cyberium's engineering team brings decades of experience securing critical infrastructure:

- Deep expertise in AVEVA PI Systems architecture and administration
- Proven track record in OT cybersecurity and Purdue model implementation
- Understanding of operational requirements unique to industrial environments
- Commitment to solutions that work in the real world, not just lab conditions

Industry-Proven Reliability

- Multiple years of continuous uptime in production environments
- Deployed across critical infrastructure sectors: energy, utilities, manufacturing, chemical processing
- Trusted by security auditors and compliance teams
- Zero security incidents attributable to MICA installations

Future-Proof Architecture

- Leverages native PI AF SDK—evolves with AVEVA's platform
- Modular design accommodates new data sources and destinations
- Cloud-ready for hybrid and edge computing architectures
- Scalable from single plants to global enterprises

Conclusion

As industrial operators accelerate digital transformation initiatives, the security and reliability of OT/IT data flows becomes mission-critical. The compromise of PI Data Archives represents a proven, high-impact attack vector that threat actors actively exploit. Traditional replication approaches leave this vulnerability unaddressed. Cyberium MICA transforms PI replication from a security liability into a strategic advantage.

By combining hardware-enforced isolation with native PI AF SDK performance, MICA enables organizations to:

- Unlock the full value of OT data for analytics, optimization, and cloud integration
- Eliminate the primary attack path from IT to critical OT systems
- Reduce operational complexity and licensing costs
- Achieve compliance with the most stringent security standards
- Future-proof infrastructure for Industry 4.0 initiatives

For critical infrastructure operators, this isn't just a technical upgrade—it's a strategic safeguard for the integrity, availability, and security of their most vital systems. Cyber resilience begins with controlling how data crosses network boundaries. MICA gives you that control.

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