Digital Twin as a Cybersecurity Tool: Applications and Value

eFORT Demonstrator 4 – Case Study 2

Funded by the European Union

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From development to value: using the High Voltage Substation Digital Twin for cybersecurity-oriented application, training and analysis.

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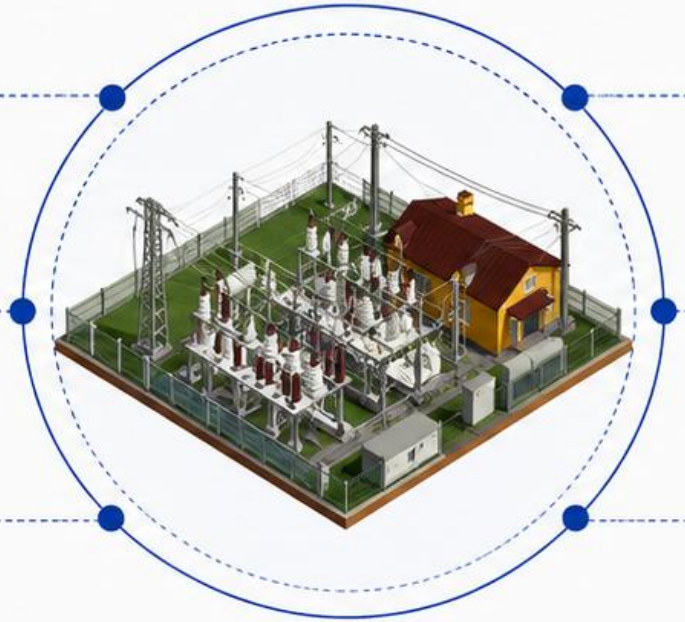
From 3D environment to cybersecurity-oriented interface

The digital twin connects physical infrastructure with information systems and cybersecurity components in a single visual and contextual environment.

Physical assets
Equipment, buildings, infrastructure

Operational data
SCADA-related views (test mode)

Contextual data
Maintenance records, documents, procedures



Automation & cyber components
RTU, SecureBox and network devices

Communication channels
Networks, links, connections

Training & awareness
Visualisation for safe analysis and learning

A safe, controlled environment for demonstration, training, awareness and analysis of cyber-physical concepts.

Practical use cases in the demonstrator

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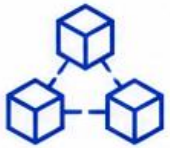
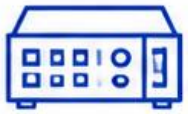


Blockchain-backed maintenance information

Trusted and traceable maintenance records are provided by the CIRCE blockchain layer and visualised inside the digital twin via WebView screens.

SCADA-related views (test mode)

Access to SCADA server and test bench information for demonstration and training purposes.



Automation components (test mode)

Visualisation of RTU, SecureBox and other automation assets and their role within the substation environment.

Embedded WebView information layer

Virtual monitors provide contextual access to different types of information directly inside the 3D scene.

Safe, contextual access to information for awareness, demonstration and analysis.

Training and educational value

Training centre application

Use in our training centre for familiarisation with substation layout, equipment, labels and procedures.

Scenario-based exercises (potential)

Virtual scenarios for maintenance operations, inspection, switching procedures and emergency exercises based on company procedures.

For new employees, trainees and interns

A safe environment for learning before working with real infrastructure.

For students (electrical engineering)

Support for education and understanding of real substation environments and cyber-physical relationships.

A safe and repeatable environment for learning, practice and familiarisation.

Digital Twin technology enhances skills, knowledge and confidence – without risk to people or equipment.

Replication potential for other substations

We have already gone through the full development chain from real site to deployable digital twin application.

1 **Capture**

Real site

2 **Process**

Scan data

3 **Model**

BIM

4 **Prepare**

3D model

5 **Implement**

Unity

6 **Deploy**

Standalone app

A unified visual interface and standard approach can be reused and adapted for other substations, ensuring consistency, efficiency and scalability.

Future development roadmap

1. VR / AR integration

Immersive training and inspection scenarios.

2. Maintenance information expansion

Richer asset information, history, documents and condition-related data.

3. Blockchain layer scaling

Scaling the trusted traceability concept for more assets and processes.

4. Scenario-based training

Realistic virtual scenarios for maintenance, switching and cybersecurity awareness.

5. Communication channel dashboard

Visual dashboard for network and security administrators showing links, channels and statuses.

6. Real-time data integration (potential)

Future option to visualise near real-time read-only data.

Video demonstration

In the next step, we will show the video demonstration of the High Voltage Substation Digital Twin.

1. Installation and launch process
2. Navigation and interaction inside the substation
3. Virtual monitors and information access
4. Test-mode views and cybersecurity components
5. Maintenance information and contextual data

The video demonstrates how the digital twin supports cybersecurity awareness, training and analysis in a safe and controlled environment.

Thank you for your attention

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