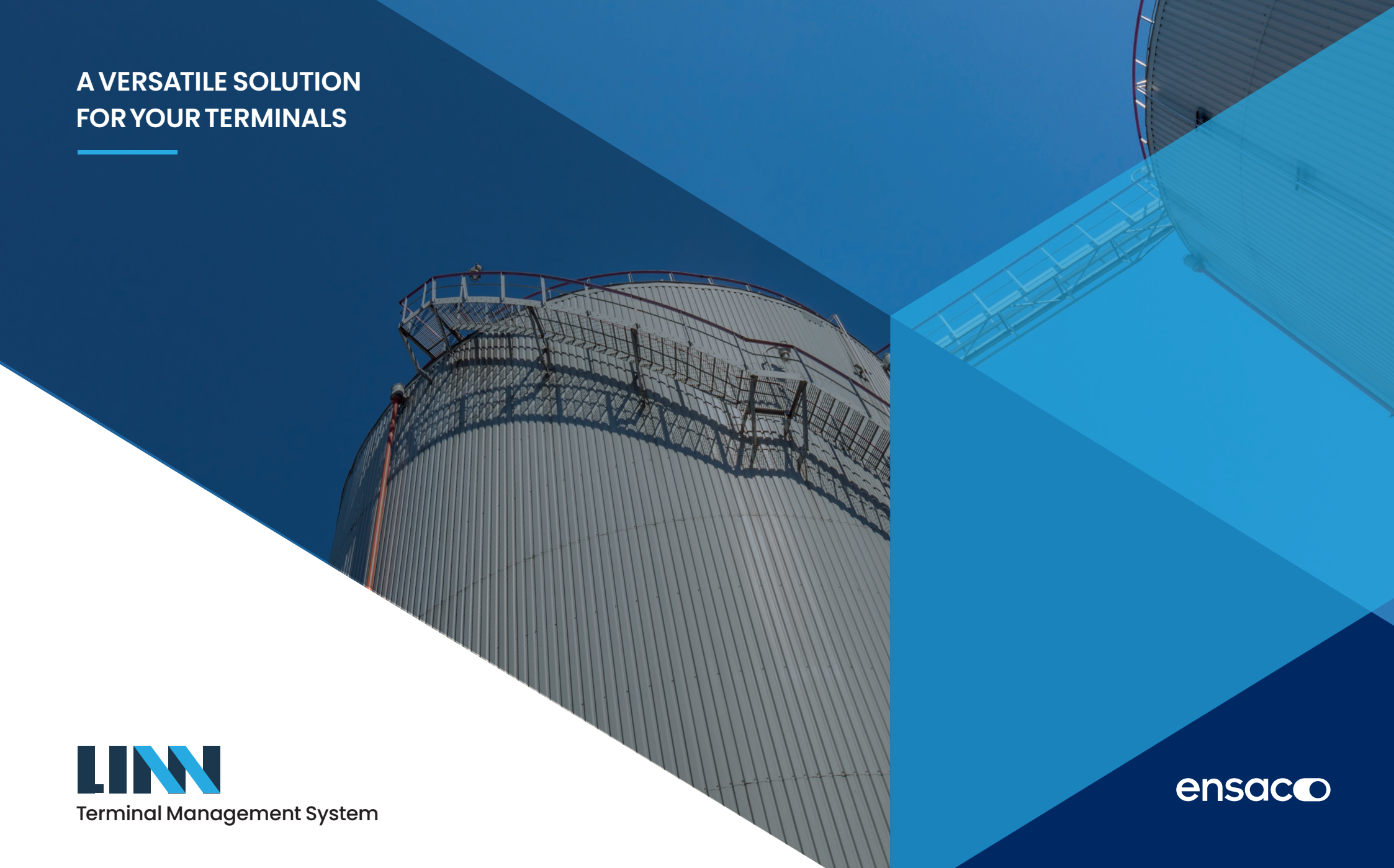
A VERSATILE SOLUTION FOR YOUR TERMINALS



LINN

Terminal Management System

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Terminal automation nowadays is built on modern and distributed principles with the idea to comply to rigorous requirements from both business/administrative and technological/operational world. Thus, a management system in such environment is obliged to support various functionalities.

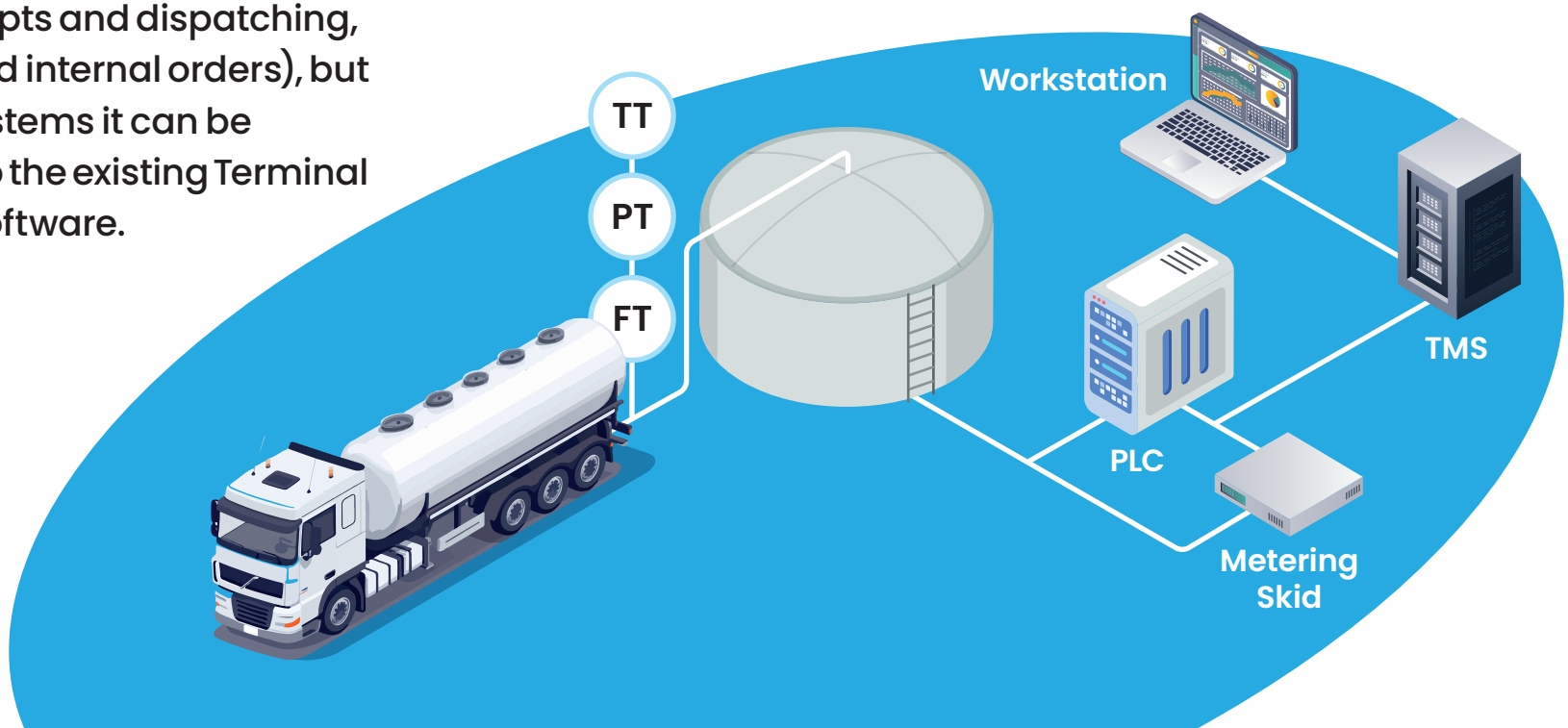
Whether the needed solution is for small, medium or large tank farms with terminals for loading/unloading oil and gas, or there is a requirement to integrate several terminal management systems into a single solution, the LINN TMS can offer an easy-to-handle and highly customizable system.

Our Physical Process Simulation feature allows the creation of one or more testing environments, minimizing risks and reducing the time required for business process customization.

Solutions for your business

The TMS can be integrated in various ways. Depending on complexity, for a smaller implementation, it can be installed with an additional module related to administrative tasks (receipts and dispatching, external and internal orders), but in larger systems it can be attached to the existing Terminal business software.

The LINN TMS can be used for small scale Terminals. Here, all TMS functionalities can coexist with a small-sized SCADA inside one computer. With an additional administrative module all required tasks can be accomplished from one operator place. This configuration can be easily adapted and scaled if necessary. On the other hand, the LINN TMS can completely cover most comprehensive Terminal management workflow control.

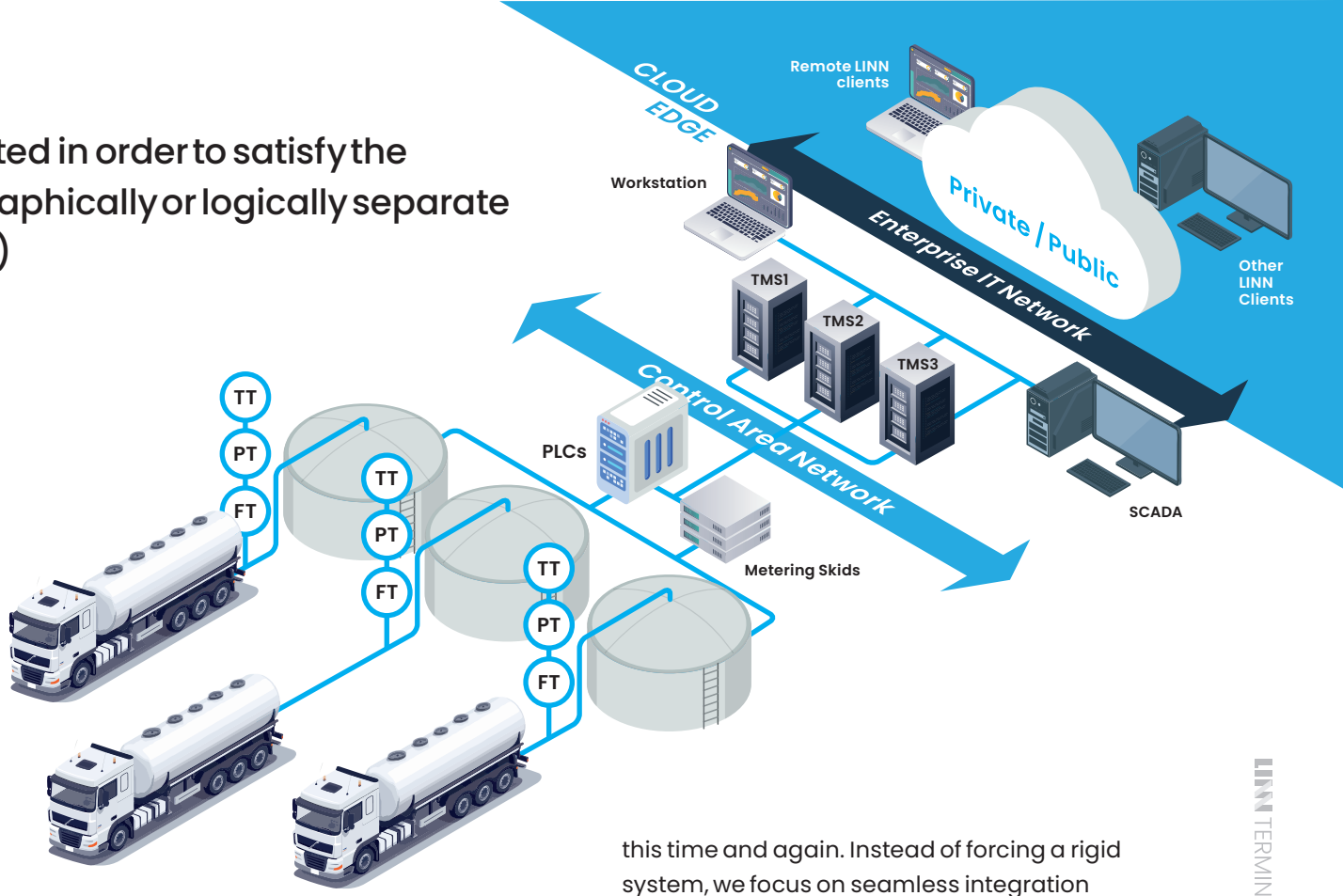


TMS node units could be distributed in order to satisfy the requirements for covering geographically or logically separate segments (Oil, Derivates, Coke, ...)

The Terminal Management System can be operated either from the TMS Client embedded in the same hardware along with a Terminal System SCADA or as a standalone TMS Client workstation. The TMS supports both directions, control and monitoring thus, it can supply a wide range of data to SCADA for presentation. Integration can be achieved with standard industrial communication protocols (e.g., OPC UA).

The LINN TMS supports different maintenance approaches with providing and information flow to the maintenance crew with the help of an application that can be hosted on tablets or pocket helpers over a Bluetooth or Wi-Fi connection. Maintenance can do additional parametrization of metering units if necessary.

In today's business landscape, seamless integration is key. LINN TMS supports a standard set of interfaces (HTTP, MQTT), enabling full compatibility with any application environment and software infrastructure. With built-in security protocols, it operates securely on both sides of the Edge/Cloud barrier.



When it comes to business and ERP integration, we know that a one-fits-all approach doesn't work — our experience has proven this time and again. Instead of forcing a rigid system, we focus on seamless integration with the software you already use. Every installation of this kind requires some level of IT adaptation, and we ensure this process is efficient and hassle-free. Our team is fully prepared to handle this IT projects — from logistics and consulting to custom development, all while strictly adhering to your company's IT policies.

LINN TMS offers cloud-based accessibility and supports a range of critical services, including:

Real-time data logging for historian storage or for AI stream

Business intelligence applications accessible across enterprise IT networks

Remote LINN clients for secure reconfiguration and diagnostics

For the purpose of an extension or further development of the system, either in the IT or OT segment, encrypted communication is supported for engineers or business application developers. If necessary, the TMS can be implemented with a redundancy support, thus ensuring a reliable operation.

The following table suggests a possible deployment of the LINN TMS (dark grey segments already exist in the Terminal System):

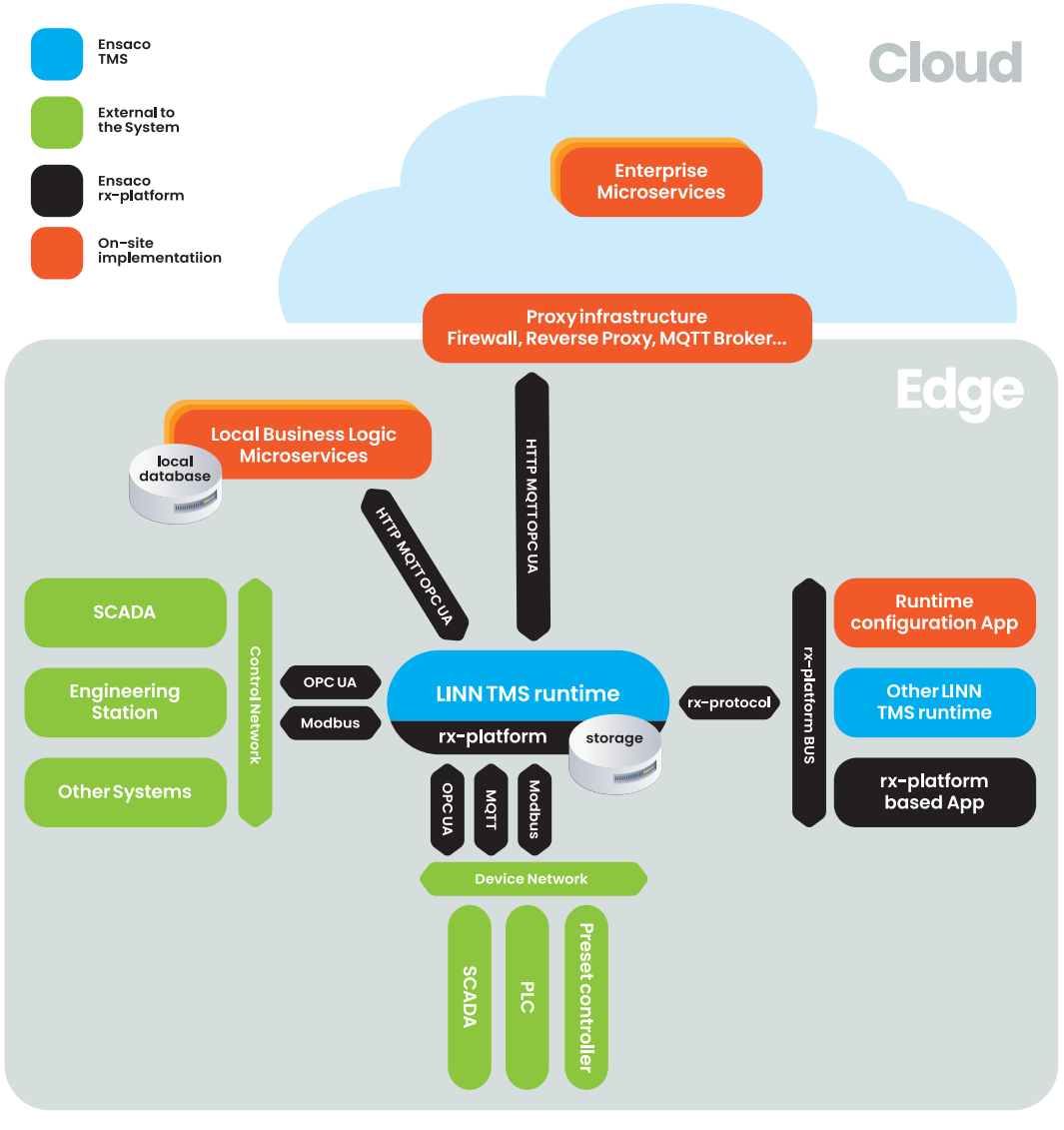
1–3 Small-sized Terminals	5–20 Medium-sized Terminals	20+ Large-scale Terminals
ERP	ERP	ERP
Administrative services	Administrative services or Terminal Business Infrastructure	Terminal Business Infrastructure
Standard protocols (REST API / MQTT)	Standard protocols (REST API / MQTT)	Standard protocols (REST API / MQTT)
LINN TMS node (redundancy option)	LINN TMS node (redundancy option)	distributed LINN TMS
Engineering Client	Engineering Clients	Engineering Clients Maintenance Clients
SCADA	SCADA	SCADA
PLC / Metering Skids	PLC / Metering Skids	PLC / Metering Skids

LINN TMS Architecture

LINN TMS is fundamentally an Edge Terminal Management System, designed to maintain a clear separation between business and operational software technologies. This distinction is crucial due to the differing development cycles, maintenance requirements, and reliability standards of industrial and business applications. Ensuring their independence is essential for optimizing the total cost of ownership (TCO) of the system.

At the core of LINN TMS is a robust data interface, built on our extensive experience. This interface is designed to accommodate virtually all loading and unloading scenarios currently in production, ensuring smooth and efficient data exchange between business and operational layers.

This virtual isolation provides cost-effectiveness and a lower maintenance investment. Some portions of the system can be hosted in the Cloud, but with a clear function to secure Operation technologies from external threats, serving as a demilitarized zone.



LINN TMS is designed for **maximum flexibility**

Stand-alone system

Can operate independently with a custom interface tailored to specific site requirements.

Enterprise-level solution

Seamlessly integrates into large-scale IT ecosystems, providing it with enhanced control and flexibility over loading processes.

Integrated component

Functions as part of a broader system, such as serving as a single measurement point within a larger TMS system.

LINN TMS provides **scalability**

For example, there can be solutions:

With one scale without measurement points

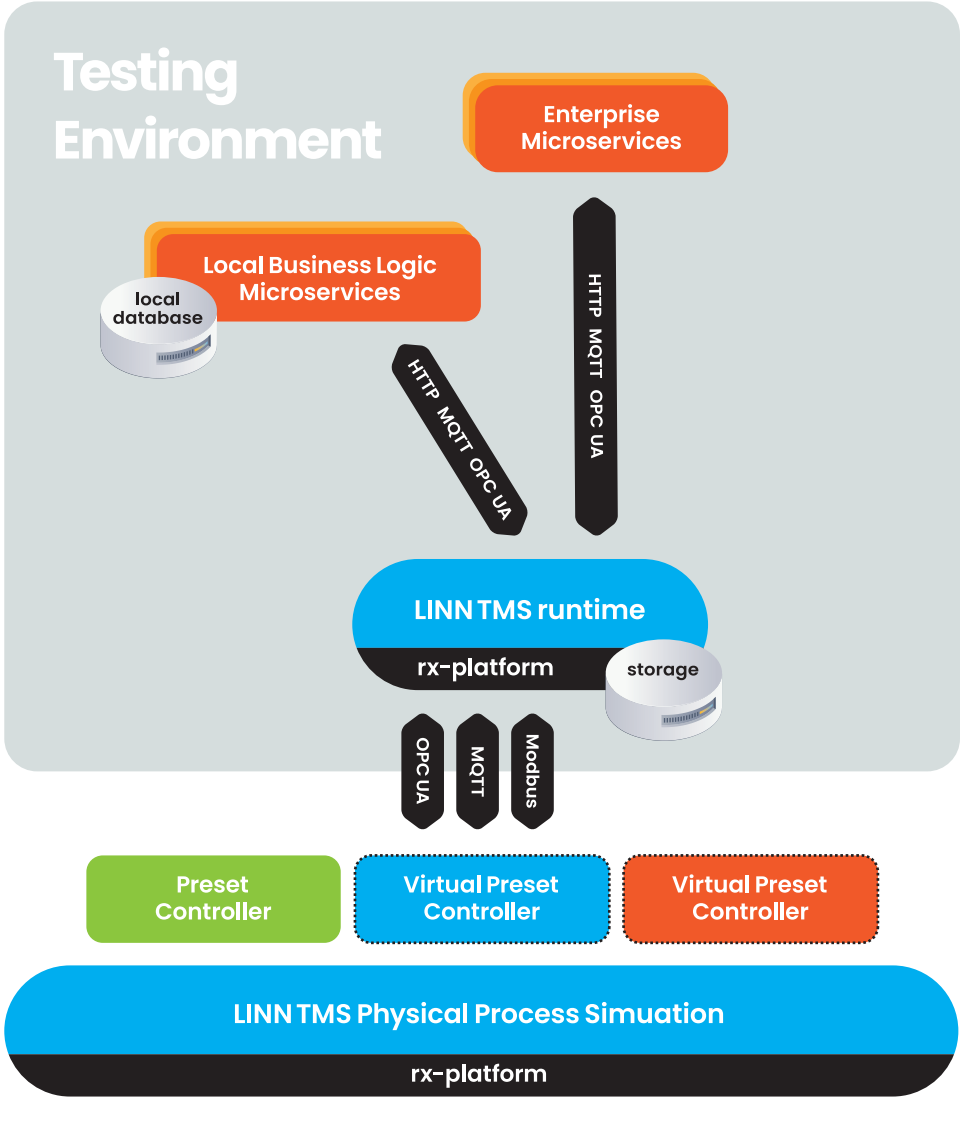
Complex system with measurement points, Scales, Pumps, Reservoirs, Parking lots, Card readers, OCR, etc.

The LINN TMS has a rich library of common Terminal System elements (objects) that are highly customizable. If necessary, a new element can be developed to match the user's requirements. Their interaction can be restricted with policies on different hierarchical levels. Policies are dynamically editable, so operators/engineers can adjust the present Terminal management workflow without the need to request the re-engineering of the system. Policies can be set in the engineering stage, but also could be overridden in real time during the exploitation by the operator or engineer. With the primary task to serve as an automation system during the process of loading, unloading and other manipulation in the Terminal system, the LINN TMS can also provide valuable data to autonomous automation systems (independent SCADA systems), thus serving as a Gateway.

LINN TMS Physical Process Simulation

One of the key advantages of LINN TMS is its Physical Process Simulation, which supports multiple test scenarios to reduce system total cost of ownership (TCO).

This simulation layer enables the creation of a "digital twin", providing a safe and controlled testing environment for the entire system. The testing system library includes built-in support for simulating selected brand-name Preset Controllers, as well as complete Process and Field equipment with easy customization.



The LINN TMS testing environment can be leveraged in multiple ways:

Software Development & Integration

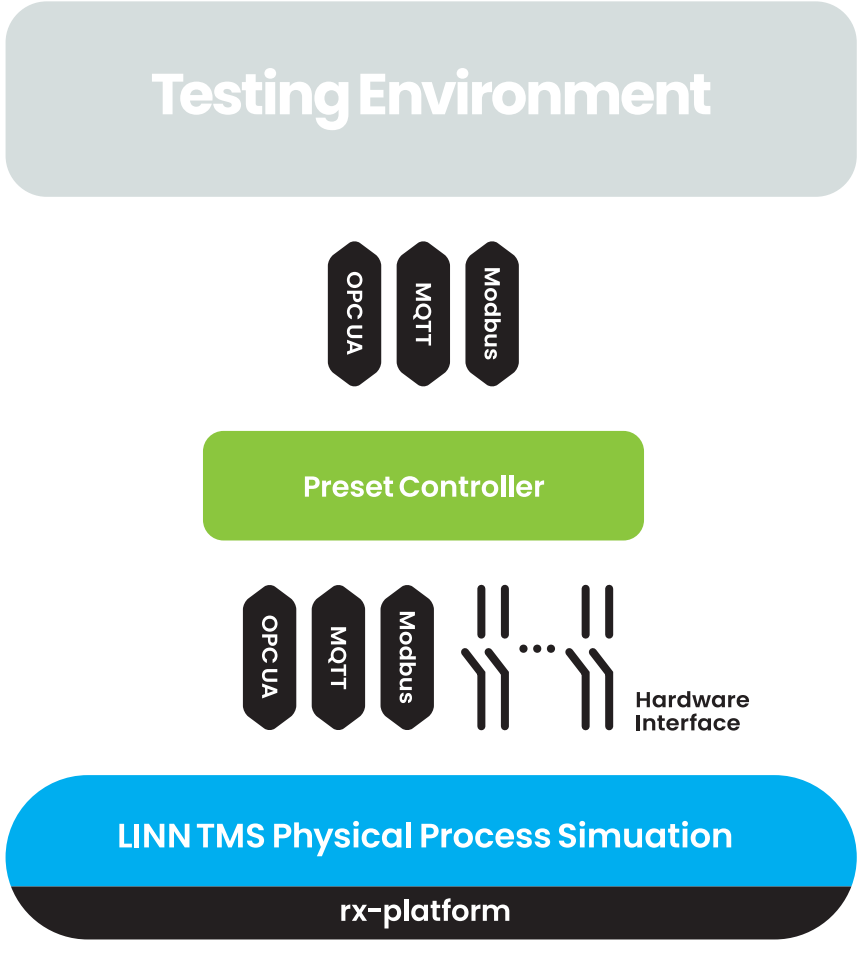
Developers can safely test code in a simulated environment, accelerating the development timeline and ensuring seamless integration between business IT projects and LINN TMS.

Operator Training

A risk-free platform for training new personnel, allowing them to familiarize themselves with the system without affecting live operations.

Equipment Testing & Validation

A virtual laboratory for testing individual loading equipment parameters and logic. Supports both protocol-based interfaces (e.g., Modbus) and hardware interfaces (e.g., double pulses, analog and digital I/O). Enables full-scale testing without requiring additional physical hardware, minimizing disruption when making changes to field equipment.



By utilizing LINN TMS Physical Process Simulation, businesses can enhance system reliability, efficiency, and adaptability, all while reducing operational risks and costs.

LINN TMS Core

The LINN TMS is based on the ENSACO Solutions platform - RX–platform. The RX-platform is a general-purpose Real-Time Database Management System with a protocol framework and programming tools. It is basically a distributed platform for building applications that exchange Real-Time data.

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It implements a hierarchy of Classes. These classes are key enablers for the creation of higher-level applications. The RX-platform enables programmers to directly use it for Edge IoT and Industrial IoT applications, custom applications such as the Warehouse Management System, complex systems that include Operations Technologies such as a Manufacturing Execution System (MES) or any other application that needs to rely on Real-Time data.

It enables and manages connectivity to devices, databases, file systems etc. It incorporates the OPC UA and MQTT communication protocols and it is prepared to be extended with additional communication, historian, security and soft plc modules. Consequently, it consists of building blocks for a scalable industry automation solution.

The RX Platform uses standard data formats for exchange. It can be configured and additionally automated by using open development tools and high-level programming languages, thus being easily acceptable and incorporated in the existing projects.

The benefits of RX-platform deployments are tied to the overall cost of the LINN TMS. The initial costs in building the system are lower than the standard market solution in both the hardware and the software segments.

The RX-platform is built to economically deploy hardware resources. Also, it requires a very low processing power. Modularity, scalability and openness to customization are major values of this platform and all of its products.

LINN TMS Features

- Covers the complete Terminal Management workflow process, including Traffic, Scale, OCR, Metering Skids, etc.
- An inbuilt configuration interface for additional customization of the system and equipment (parameters, custody-transfer, pumps, reservoirs…)
- A rich library of common Terminal System elements.
- Policy management supports adaptation to the workflow in real-time.
- Supports sample data entry and data manipulation retrieved from the Laboratory Informational Management System
- An intuitive and efficient way to access, archive, and present both administrative and operational data.
- Peer-to-peer communication between multiple LINN TMS systems, while keeping the configuration aspects of the whole system as simple as possible. LINN TMS systems are independent from each other and yet functioning as one.
- Supports all market relevant interfaces (Microservices, MQTT, REST, JSON…).
- Supports major older generation automation software interfaces (SQL DB, WEB Service…).
- Supports the existing OT systems – provision of TMS data to other SCADA systems.
- Capability to be extended with an Edge AI component for improving work efficiency and security.
- An easy-to-handle user interface for System supervision and parametrization.

LINN TMS Benefits

- Reduced Total Cost of Ownership
- Comprehensive Terminal Management
- Seamless Scalability
- Effortless Testing Environment Creation
- Simplified Complexity Management
- Proven Reliability
- Enhanced Efficiency & Security

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