Davor Rubinić:

Digitalization trends and solutions for oil terminals

Siemens Energy / Industrial Applications /
Process Solutions / Onshore

REFINING & STORAGE

REFINING & STORAGE IS KEY SEGMENT OF OIL&GAS VALUE CHAIN

1 CRUDE OIL EXTRACTION

2 REFINING

3 OIL PRODUCTS TRADING

4 RETAIL & DISTRIBUTION

OIL TERMINAL

OIL TERMINAL

OIL TERMINAL

Modern Oil Terminal

Key aspects:

1. Safety and security
2. Environment care
3. Digitalization
4. Integration
5. Competitiveness by efficiency

Digitalization

Current drivers of Digitalization

- Computing power
- Smart Data and Analytics
- Mobility of Devices
- Smart sensors
- Virtualization
- Cloud computing
- All-time network access
- Simulation
- Virtual reality
- Cyber Security

Digitalization will continue to change the entire industry sector

- Shorter **time to market**
- **Increased flexibility** in volatile, heterogonous, global markets
- Optimized **productivity**
- Energy and resource efficiency
- Mitigation of **demographic change**
- Continuous, **safe and reliable operations**

Digitalization of Oil Terminals

DIGITAL TERMINAL APPLICATIONS

Increases tank terminal efficiency and transparency across the whole value chain

Planning and Scheduling – **TMS,** Terminal Management System

Online queuing system – **TGA** Truck Guidance Application

Operator and Customer Transparency – **KPI** Dashboard and Analytics

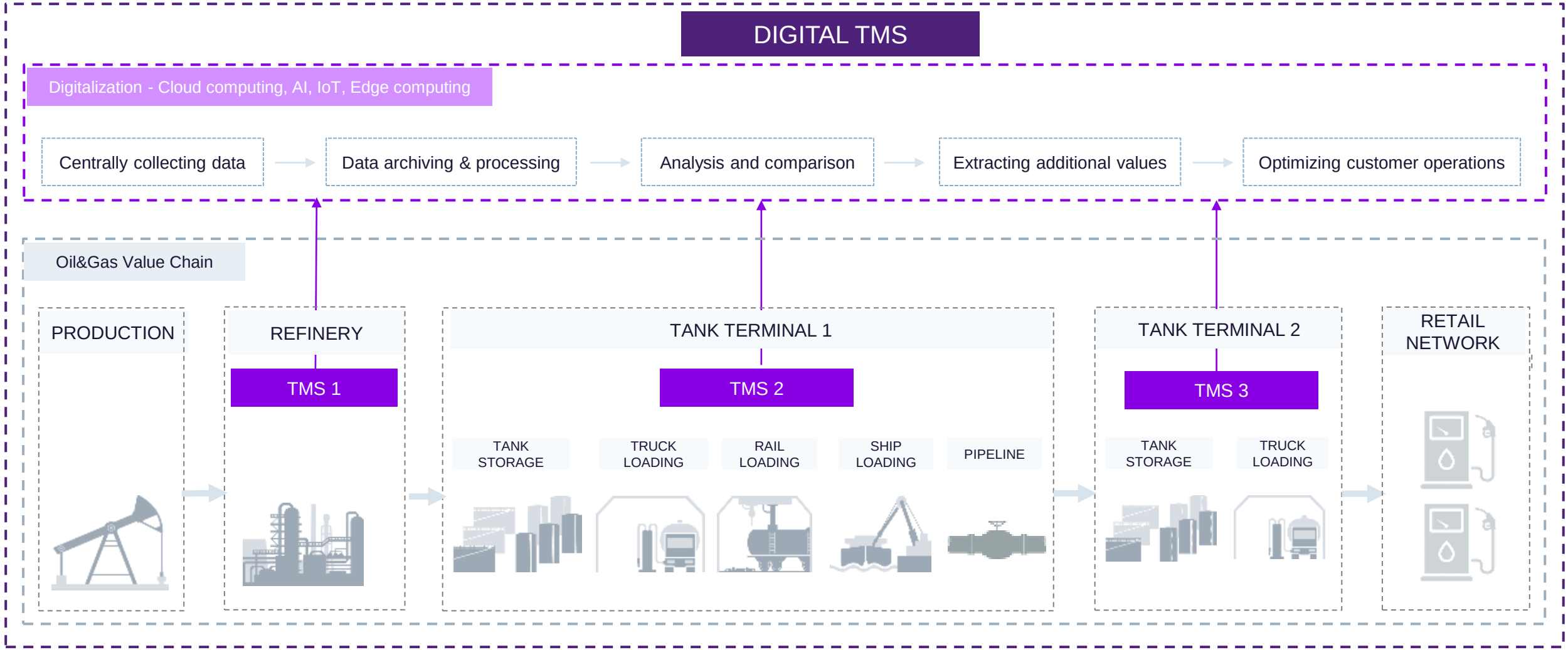
Waiting room

Entry gate

Loading bays

Exit gate

DIGITAL Terminal Management System (TMS)



October 2020

DIGITAL TMS - Overview

Reusable software for multiple industries

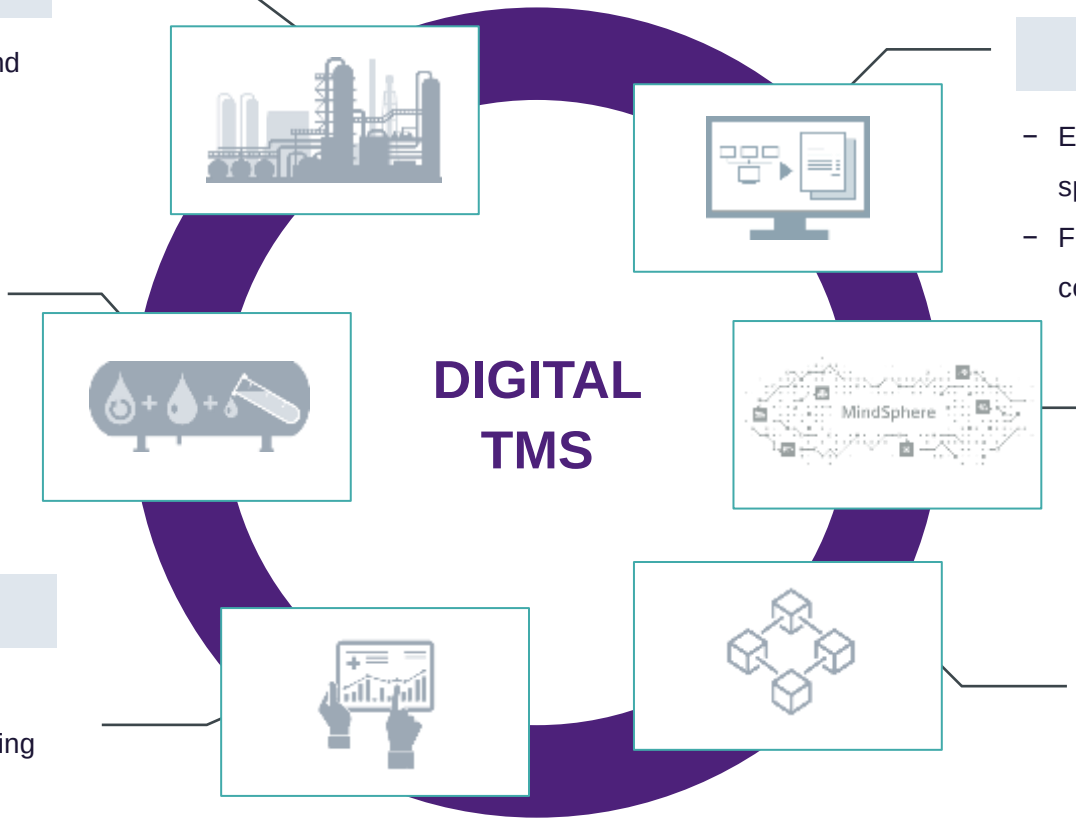
- Developed to meet the operational demands and logistic needs in all liquid terminals in various industries (e.g. Oil&Gas, Chemicals, Petrochemicals)

Inventory management

- Reliable and accurate product inventory management from supply to dispatch, optimizing operational processes

Digitalization features

- KPI Dashboard and analytics
- Fleet management, scheduling, GPS and geo–fencing vehicle tracking
- Artifical Intelligence for value comparison (Stock accuracy)



Modular design

- Easily adaptable and configurable to customer specific requirements
- Flexible architecture with Cloud and Edge computing

IoT

- Smart sensors connected with control and management system that enables unmaned operations

Trusted reporting

- Tank inventory and Bill of Lading will be based on trusted encryption and reporting using Blockcahin Technology

Digital Terminal Management System – Modules

DIGITAL TERMINAL MANAGEMENT SYSTEM

TERMINAL MANAGEMENT SYSTEM

Management of fuel oil storage and transfer operations

OIL TERMINALS

SCHEDULING | QUANTITIES | AVAILABILITY | UTILIZATION | THROUGHPUT

KPI DASHBOARD and ANALYTICS

Digital management of tank terminal processes (Analytics of handling, trading and storage / demand balancing)

VIRTUAL TERMINAL

Maximizing operational performance with complete tank terminal processes transferred into the virtual environment

Terminal Management System – According to ISA-95 standards

Enterprise level

ISA-95 – level 4

ERP system

Business development, resource and cash management, financials, pay roll, human resources, inventory levels

Time frame

Months, Weeks, Days, Shifts

Business process network

Execution level

ISA-95 – level 3

MES – Manufacturing Execution System

Operations management, detailed production scheduling, managing events, batch workflow, recipe control, stepping processes through states

Time frame

Shifts, Hours, Minutes, Seconds

Operation network

Automation level

ISA-95 – level 2

Process Control and Monitoring

Monitoring, Supervision and Automated Control of Process, Batch Control, DCS, SCADA, PLC, HMI

Time frame

Milliseconds

Terminal Management System – According to ISA-95

Enterprise level

ISA-95 – level 4

ERP – Enterprise Resource Planning

- Customer relationship management
- Finance and accounting
- Project management
- ERP
- Supply chain management
- Human resources management
- Manufacturing and delivery management

Business process network

Execution level

ISA-95 – level 3

TMS – Terminal Management System

Operation Management	Access Authorization	Reporting	Assigning Personnel
Operation Workflows	Transaction Authorization	Order Management	Managing Events
Loading Scheduling	Inventory Management	Delivery Documentation	Operations Status
Automatic Queuing	Discrepancy Reports	BOLs	Performance Analysis

Operation network

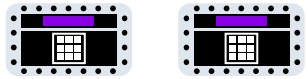
Automation level

ISA-95 – level 2

Automation System

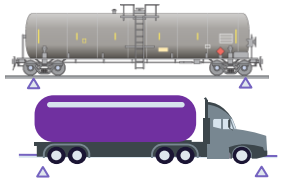
Tank Gauging System

Metering Systems



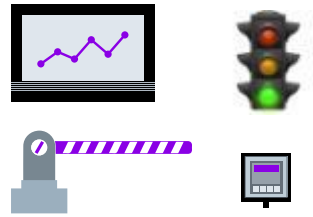
Preset Controllers/
Flow Computers

Weighting Systems



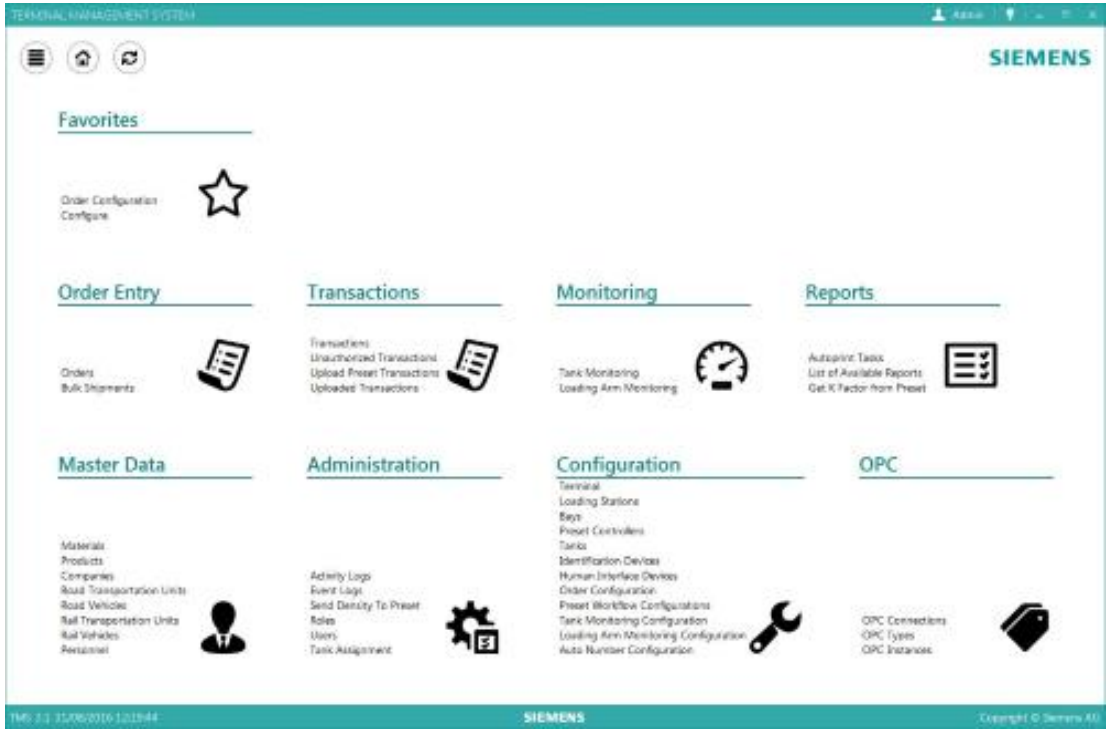
Weight scales

Traffic Management



TMS, Terminal Management System – MES, Manufacturing Execution System for Tankfarms and Refinery storage

TMS	Highly flexible tank farm & terminal management system, representing tank terminal operations as graphical workflows, effectively synchronizing, coordinating, analyzing and optimizing the entire tank terminal process




Tank storage


Truck Loading


Rail Tank Car Loading


Ship Loading

- Tank status management and inter tank transfer
- Product inventory management across the whole value chain
- Order management
- Reporting and Traceability
- Access control and authorization

Terminal Management System – Customer benefits

- Enhanced efficiency of loading facility, more than 10%, higher output enabled by TMS queuing and plant workflow
- Integrated access control simplifies loading authorization
- Increased safety and lower personnel error probability
- Automatic queuing and automatic printing modules reduce personnel workload
- Systematic quantity tracking and stock reporting enabling early discrepancy detection

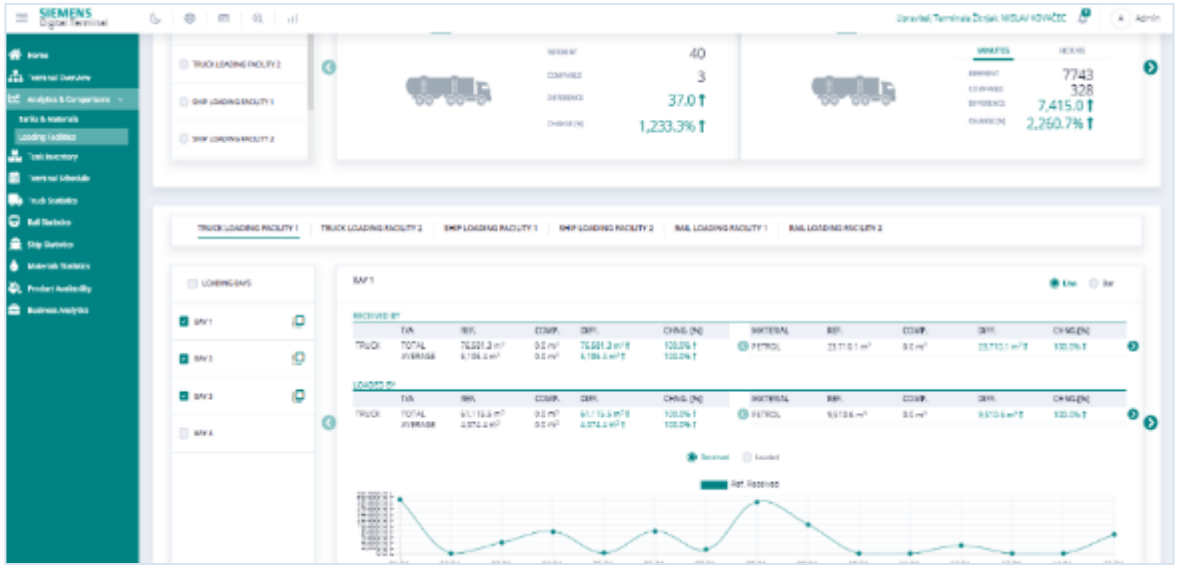
- By Hardware clustering and virtualization
  - High availability and High reliability, resulting improved business continuity
  - Easier maintenance, configuration and server management
  - Simplifies implementation, maintenance and system expansion
  - Cost effective and fast system expansion, requires less effort, and combined with usage of Thin Clients requires less hardware
- Standardized pretested and reused solution reduces implementation risks
- Software flexibility expressed by possibility of adding parameters, additional loading units and reports without software developer involvement. Can be done through system configuration

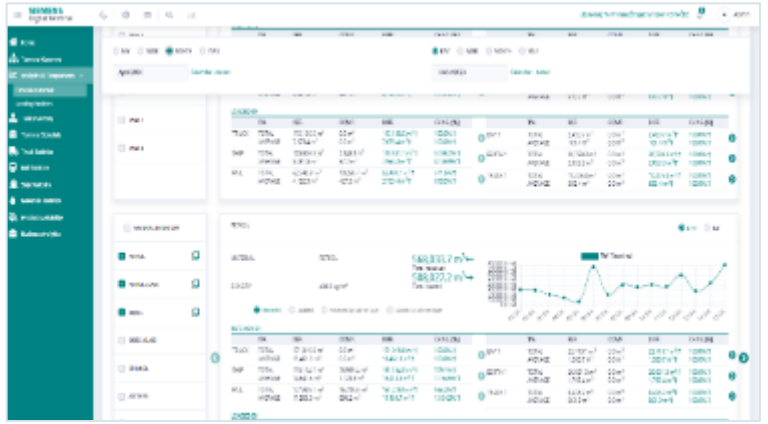
Digital Terminal Management System – KPI Dashboard & Analytics

Digital management of tank terminal processes by:

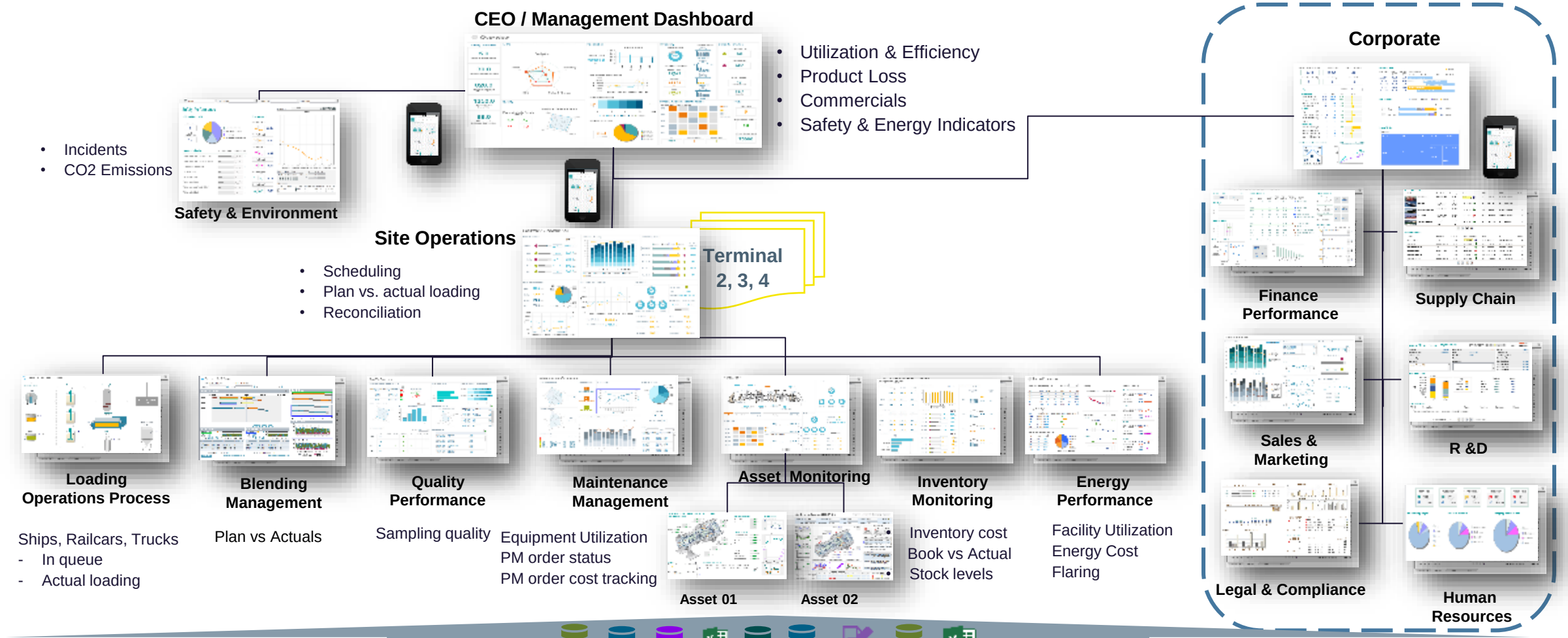
- **KPI analytics:**
  - for better strategic decision and better management on plant or enterprise level
  - Tank inventory monitoring in relation to material statistics and product availability
  - Material and product supply and dispatch adjustments in real – time
- **Business analytics**
  - Collection of data from different sources – in near real-time and historical – transparency
  - Adaptation to market trends, utilization and throughput
  - Performance Management, Improving Efficiency, tracking operating costs

Digital Terminal Management System – KPI Dashboard & Analytics





Integration of decision supporting systems across Terminals



Enabling Data Driven Decisions by Management Dashboard and Operations Intelligence

- All KPIs at one glance
- Integrate different sources of information
- Drill into details & root cause
- Real-time contextualized information
- Internal & external data
- Greater collaboration between company sectors
- Accessible over smart devices: Mobile, Tablets
- Easy to scale & extend
- Customizable

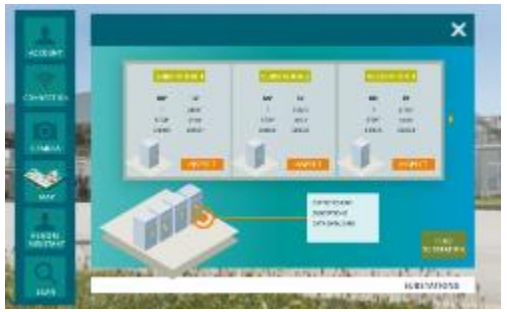
Digital Terminal Management System – Virtual Terminal

SIEMENS energy

REALWEAR APPLICATION

- Replication of tank terminal procedures such as tank inspections, substation and switchgear maintenance activities, loading procedures, equipment review, truck inspections and other in virtual environment
- Maximizing operational performance

Digital Terminal Management System – Virtual Terminal



Hololens Application

- Complete tank terminal processes in virtual environment
- Visualization, analysis and markup of tankfarm related processes in real – time

Digital Terminal Management System – Virtual Terminal

Truck Loading Facility
Number of loading bays: **4**
Type of loading: **Bottom**
Equipment availability ☑
Number of issues: **0**

Truck Loading **In Progress**
Shipment number: DZH - 432
Loading bay: **4**

Order number: ON - 410
Truck ID: TR - 18798
Compartments: 2
Customer: Crodux Derivati dva
Supplier: Crodux
Product: Euro diesel

Quantity compartment 1: **12.000 L**
Quantity compartment 2: **12.000 L**

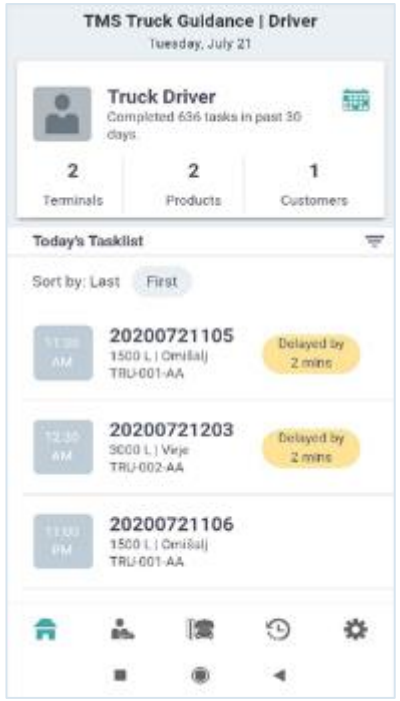
Flow rate: **3.500 m³/h**
Pump ID: PMP 345
Loading duration: **32 min**
Completion: **45,4%**

Digital Terminal Management System – Truck Guidance App

1

Before going to the terminal, truck driver logs into his Truck Guidance application with the following purposes:

- To check how many assignments are scheduled for today
- To see when does he need to be at each particular terminal
- To see if there are any delays in loading



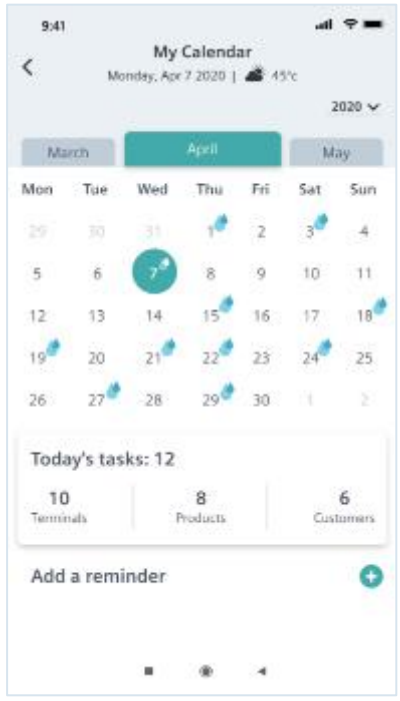
2

On the Today's Task list overview screen, an overview is given on the loading assignments with the main details:

- Loading time
- Shipment number
- Terminal name and quantity to be loaded

3

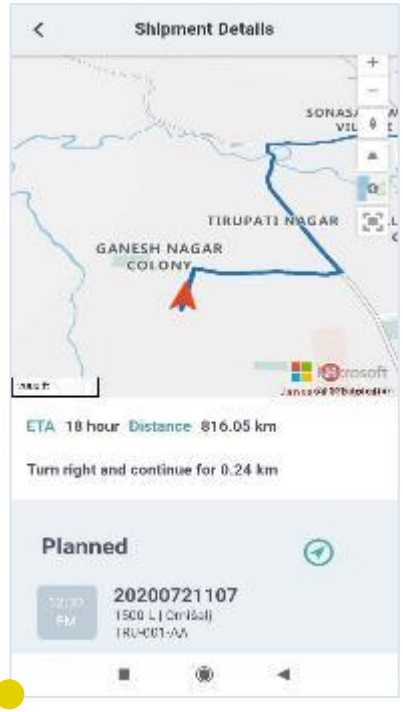
He may also consider taking a look at the Calendar page to see all upcoming loading assignments that will occur on any other day or month.



Digital Terminal Management System – Truck Guidance App

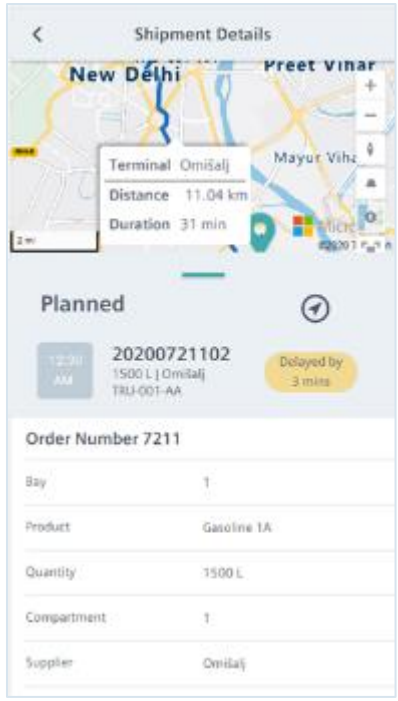
4

By pressing on one particular assignment, additional screen appears through a pull – down transition, with the Navigation feature.



5

Navigation feature can be used throughout driver's complete journey towards the terminal, with estimated time of arrival and planned loading time being updated on regular basis.

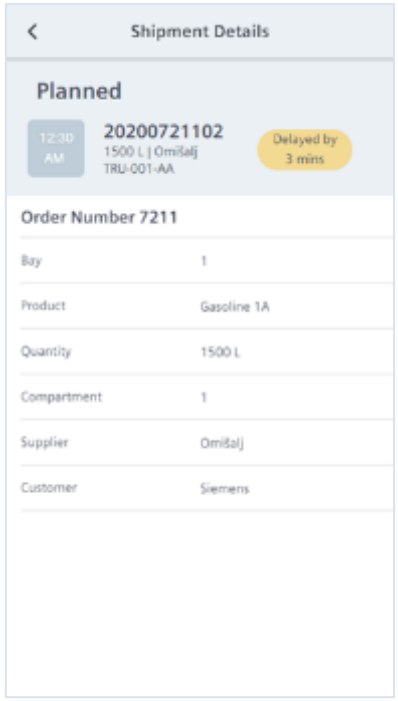


6

Once the driver is capable of confirming that he has arrived on terminal location, which is provided by the geofencing service, he will also be able to see all the specific details related to his upcoming loading assignment:

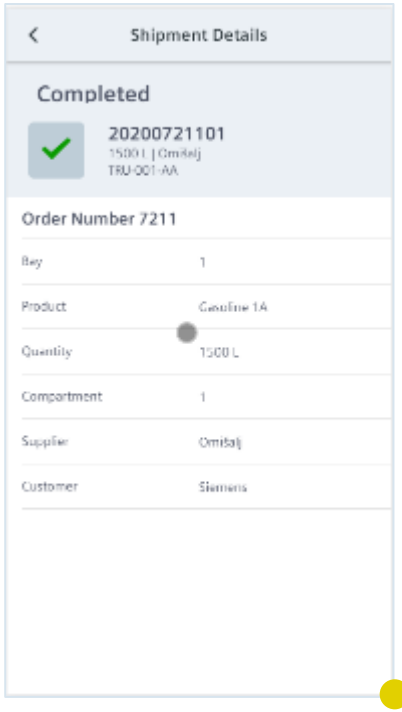
- Loading bay ID where the loading will take place
- Quantity and the product which will be loaded
- Position on the queueing list
- Supplier of the product and quantity of the product for dedicated compartments

Digital Terminal Management System – Truck Guidance App



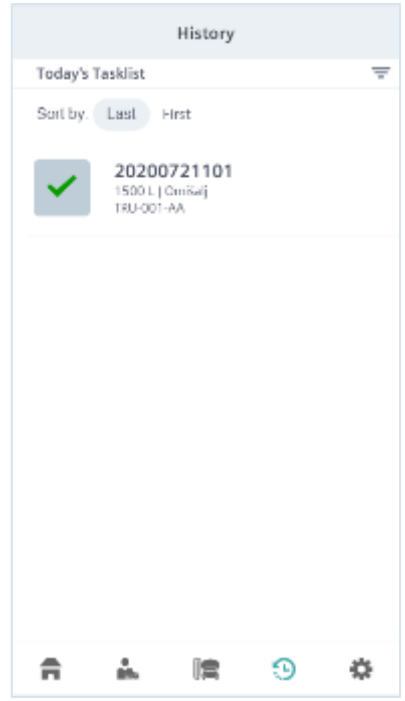
7

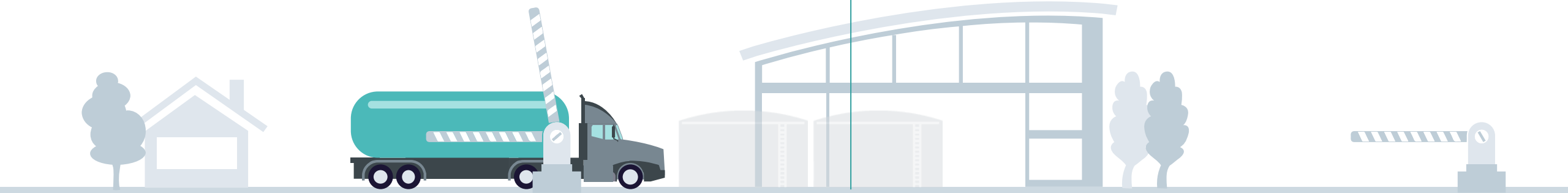
While the truck loading is taking place, the driver does not need to update or track the progress via application. Simply, when the loading process finishes, our TMS will send an update to the application



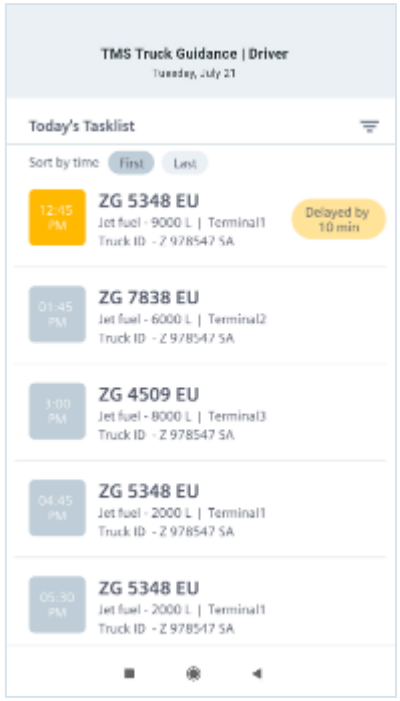
8

Once the loading assignment is being marked as completed in the TMS, that particular assignment will also be transferred to the History page of the application, where all processed and completed assignments will be stored.





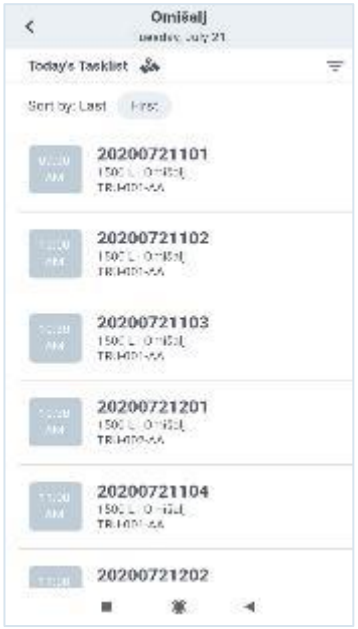
Digital Terminal Management System – Truck Guidance App

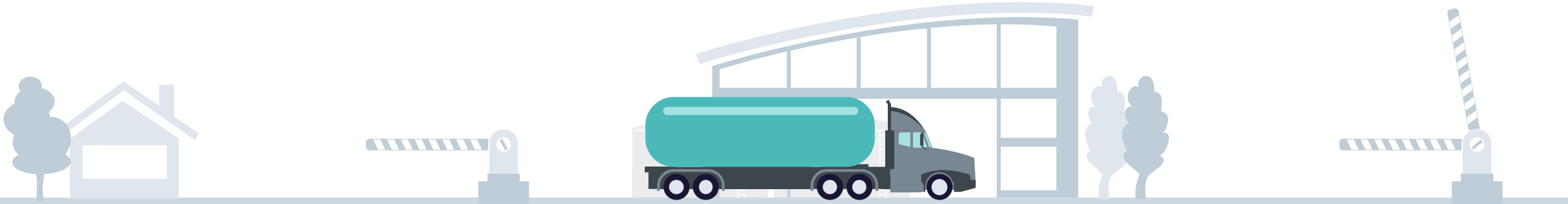


9

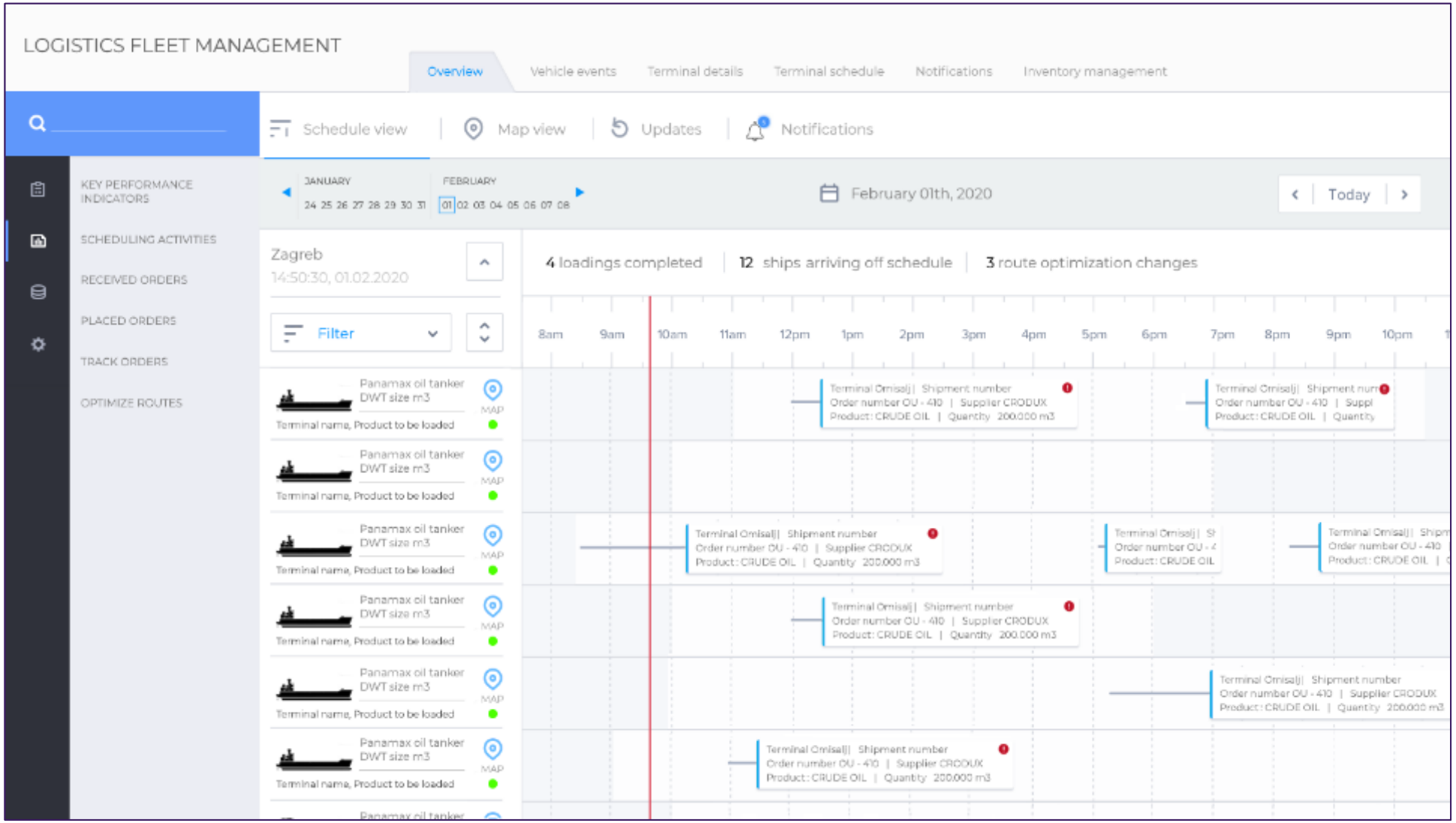
When driver exits the terminal, the assignment list is being updated and he can continue driving towards his next assignment or terminal.

At the same time, Terminal operators will also be able to use the application and see all loading assignments and truck positions related to their particular terminal





Digital Terminal Management System – Logistics Fleet Management



AI PLANNING & SCHEDULING

- Checking tankers availability
- Checking crude oil and oil product terminal availability
- Consumption prediction (Different peak periods throughout the year)
- Advanced planning based on tank terminal and loading facility availability, expected loading and waiting times and available loading time slots
- Corrective planning, Re – planning and Re – prioritizing
- Real time monitoring and awareness of tankers position, arrival time prediction, expected loading duration calculation and corrective actions
- Increasing tanker throughput by reducing waiting times; Increasing terminal throughput by efficient planning and reducing empty slots between loadings

Stock Accuracy Management

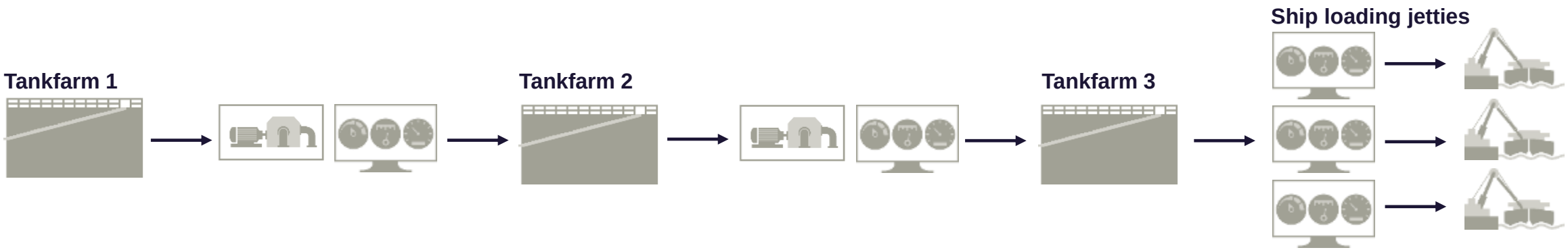
Challenge

- Shift in measurement accuracy from supplied and dispatched products throughout the year is often not detected
- Many metering points along the line and interdependent measuring devices with different accuracies
- Multiple conditions (temperature, pressure, viscosity, ...) interact within the system resulting in certain accuracy changes
- No remote equipment monitoring to enable predictive maintenance

Solution

- Digital and artificial intelligence (AI) accuracy analysis for all measurements from supply to dispatch of the products
- Continuous stock accuracy management, including visualization of potential accuracy issues with measuring devices
- Integration of automation system for optimized continuous process monitoring & real – time value comparison
- Detailed analysis, remote equipment monitoring to enable predictive maintenance, remote technical support or planned interventions

Dispatch Volume per day	1.500.000 bbl	
Increase in Accuracy	0.05 %	
Mean Price HC Product	40 $ / bbl	
	Potential Loss	
	750 bbl / day	**> 30.000 $ / day**



Digital Bill of Ladding

CHALLENGE

Bill of Lading is a mandatory document issued at the departure after every loading and unloading that is distributed to both customers and terminal owners

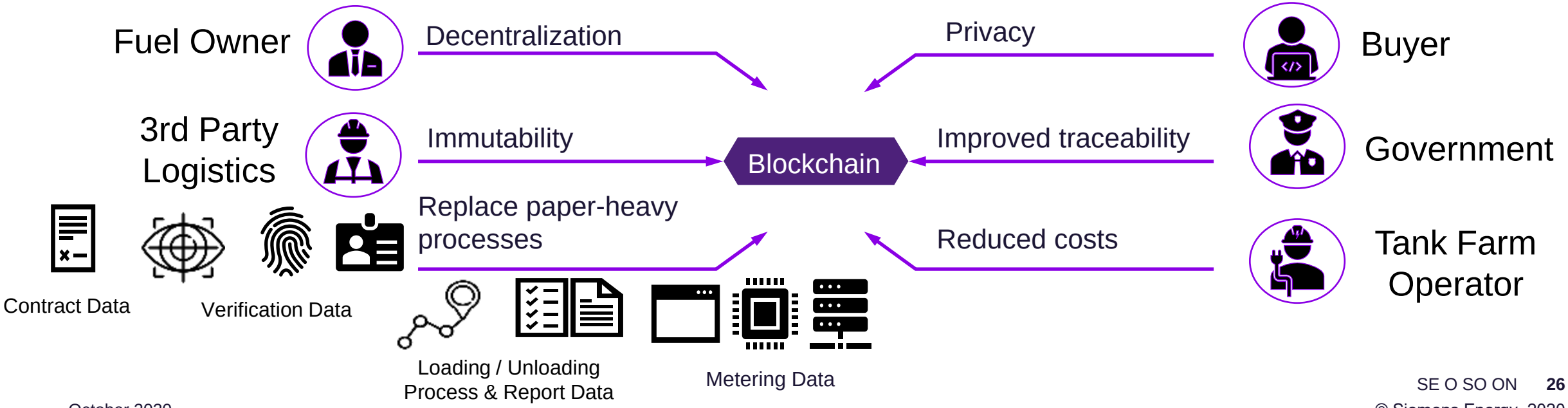
Currently, there is no way for customers and terminal owners to exchange Bill of Lading documents quickly, digitally and securely

SOLUTION

DIGITAL BILL OF LADING

Create securely written encrypted documents that are instantly issued and are immediately available to terminal owners and customers

Every report and Bill of Lading document should be paperless, traceable and securely stored in an immutable database



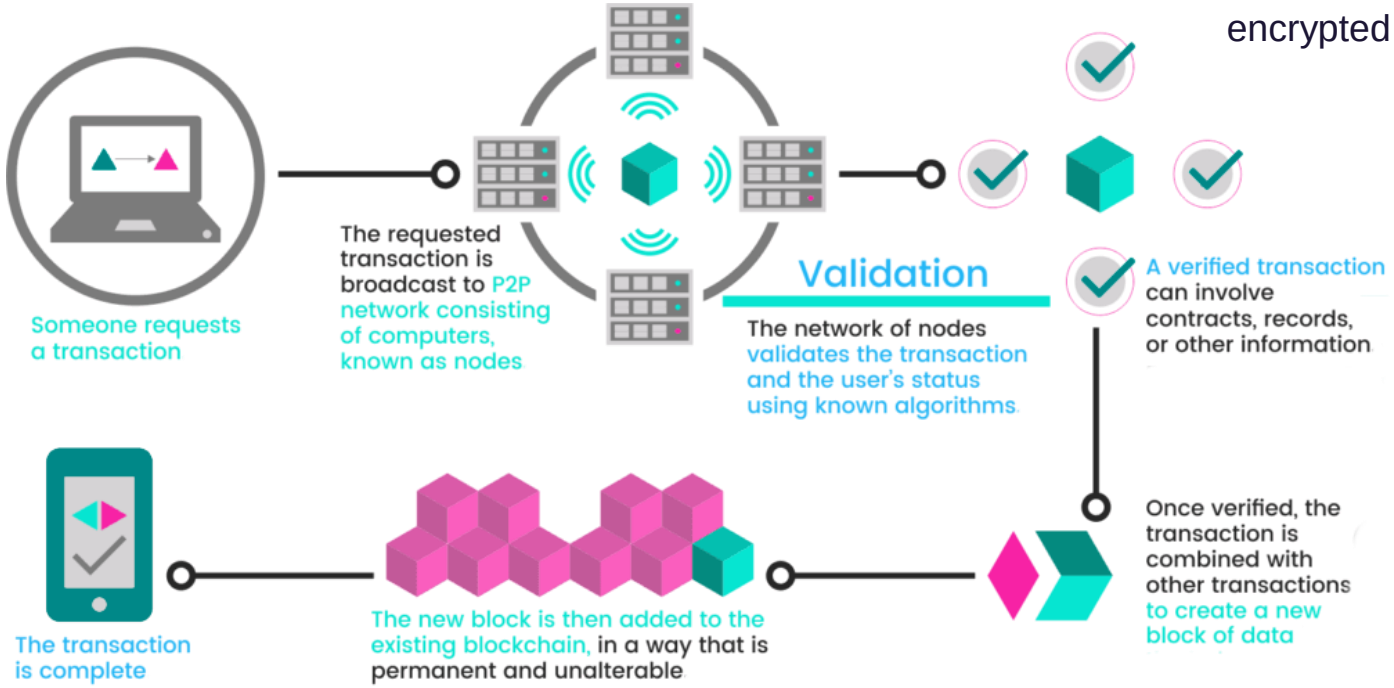
Digital Terminal Management System – Blockchain technology

Benefits

- Built on top of the blockchain's capability to transfer digital value in an open and decentralized way
- Replacing logistic documents easily and securely. Enables the transfer of products without paper handling

Smart Documents

- Documents are encrypted and securely written on the blockchain network. No central storage which could be attacked
- Documents are issued instantly and are immediately available. There is no conventional need to print, store or archive data
- Decentralized, distributed, transparent, unchangeable and encrypted database of documentation

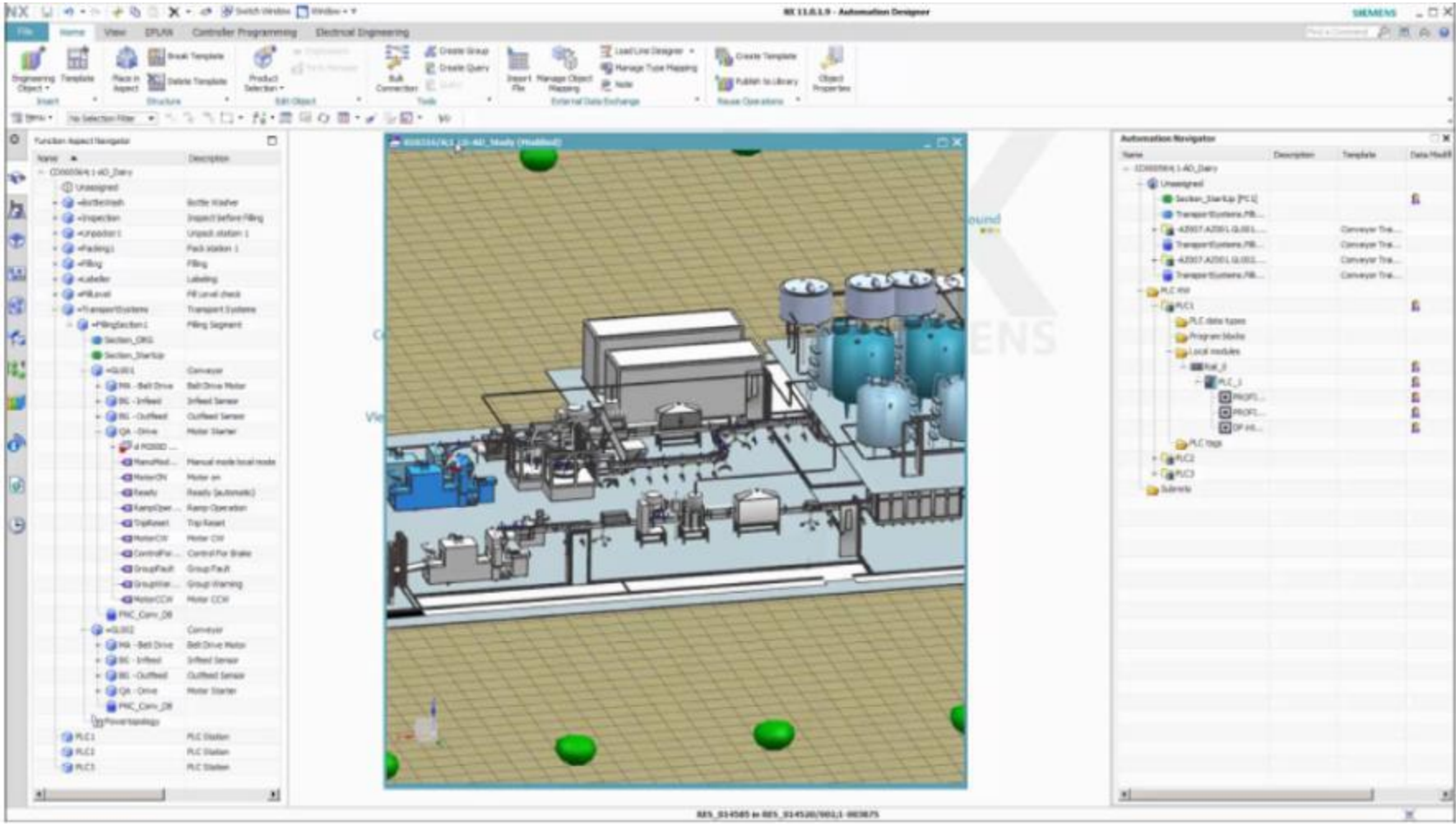


Digital Twin

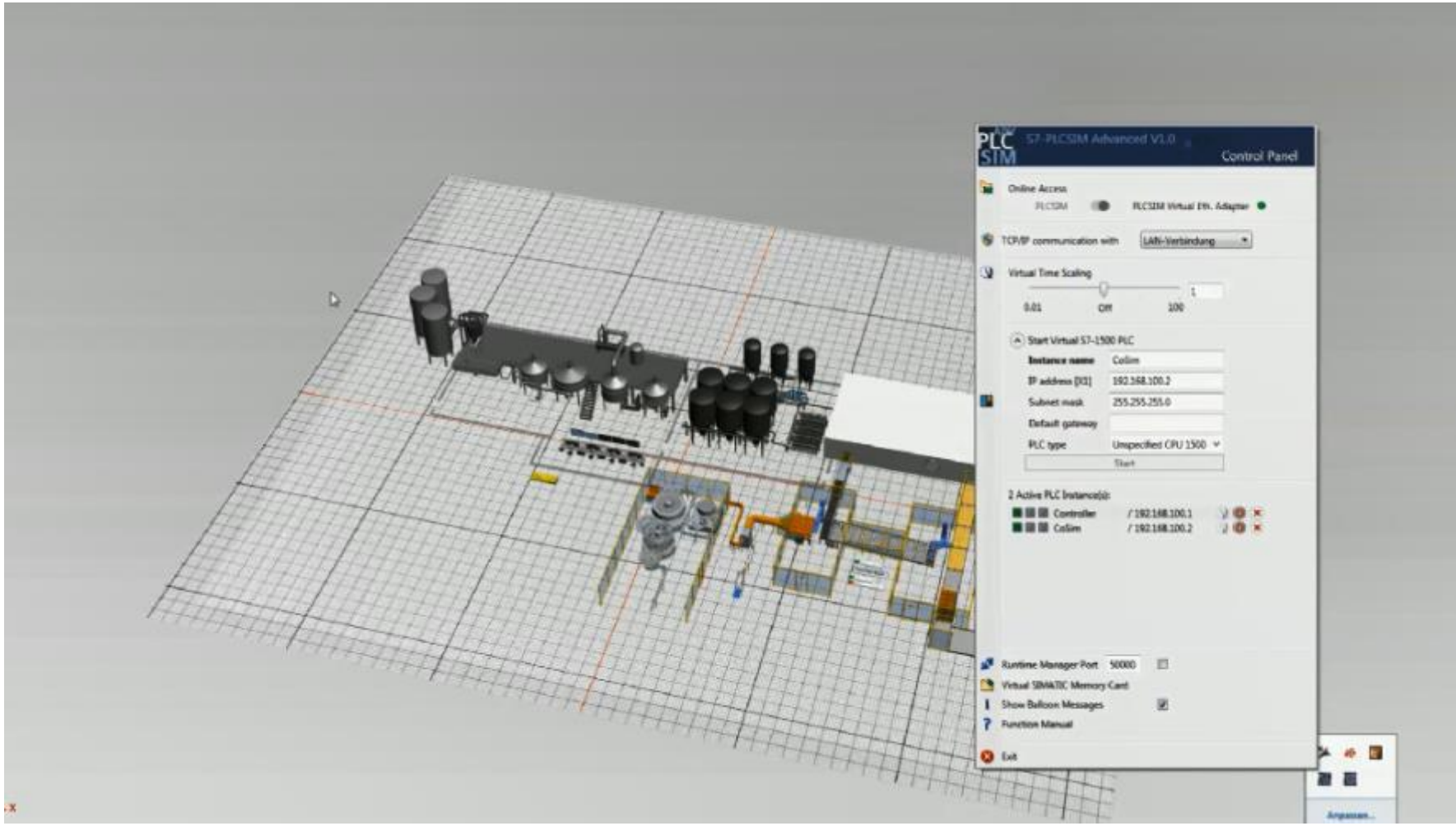
Training for operators in the virtual world

Digital Twin

Automatically generating facility design – 2D or 3D + all disciplines

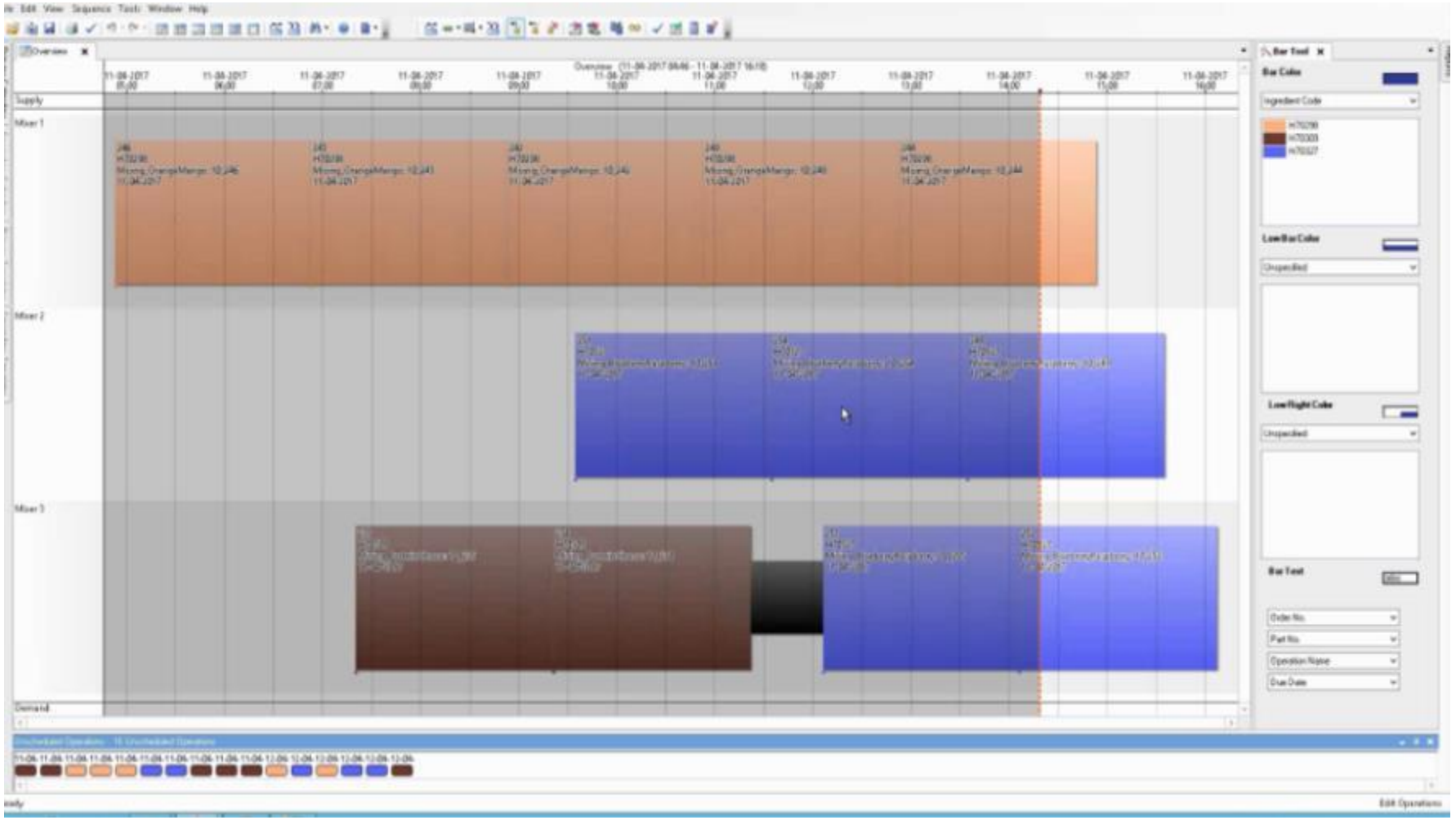


Validation of the automation and process control systems in the virtual world



Digital Twin

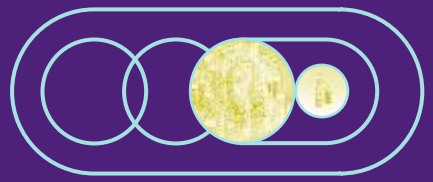
Scheduling and simulaiton of processes and operations

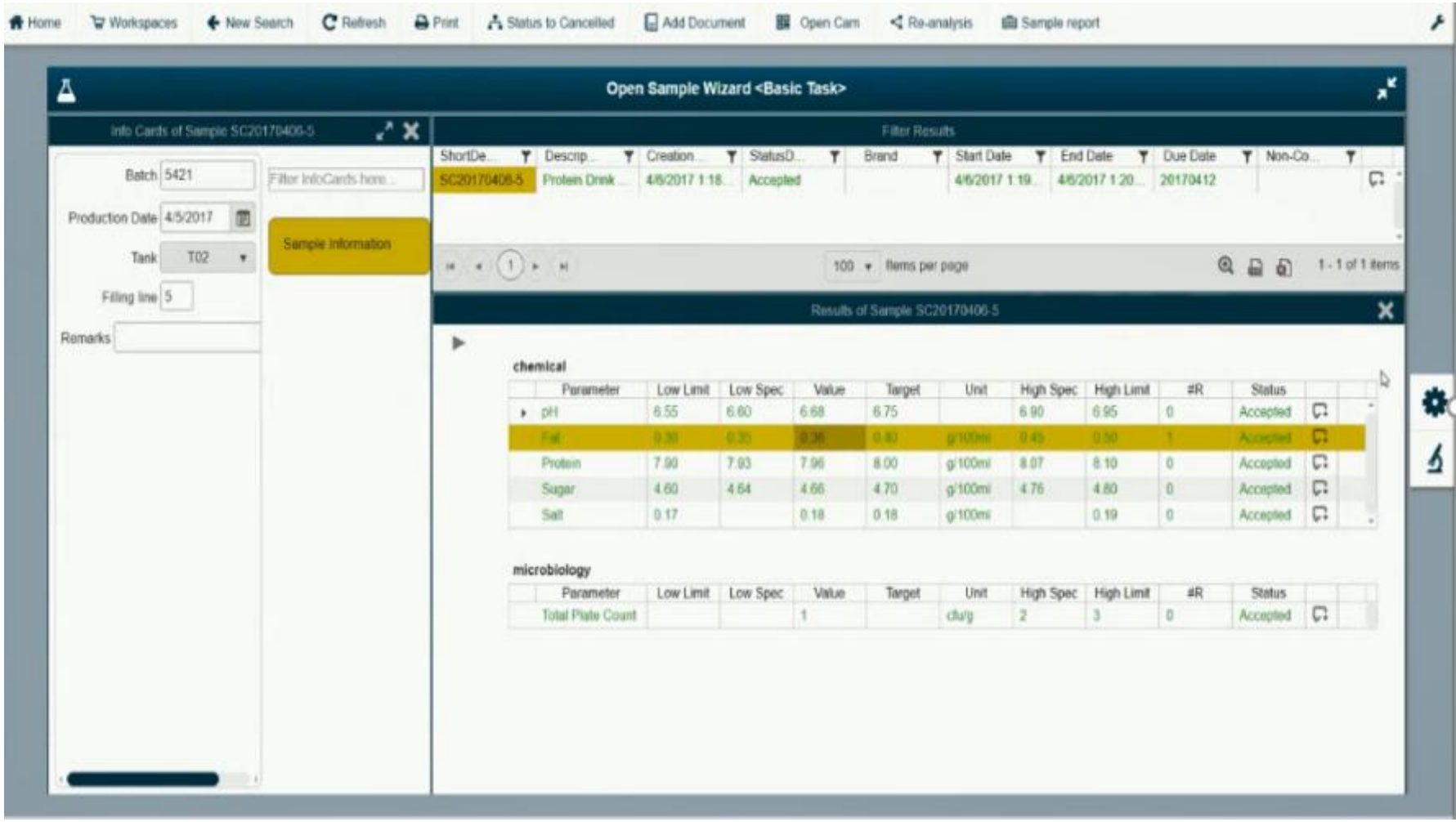


Digital Twin

Quality inspections

Products and production facilities have „built-in” digital information about their quality and their performance





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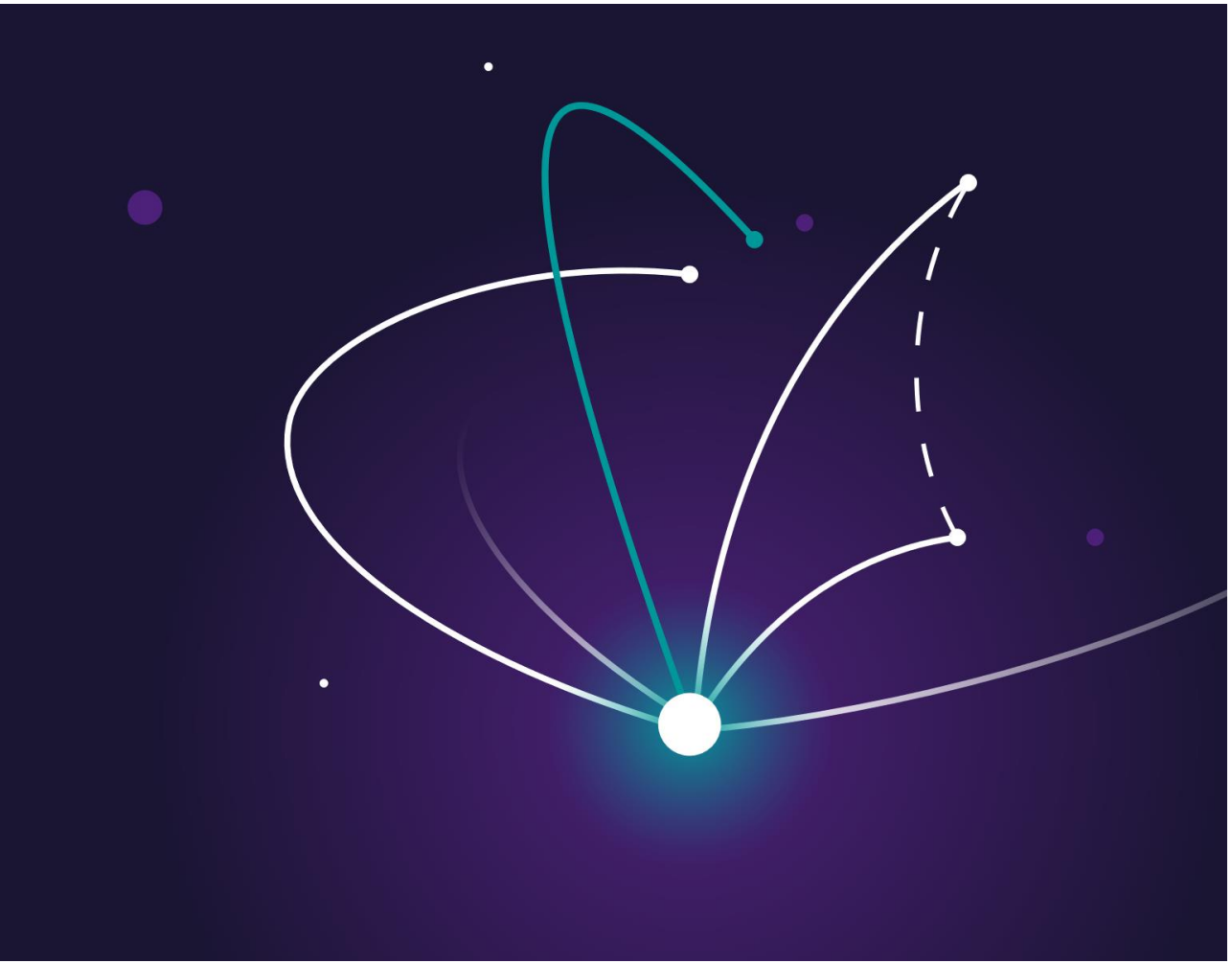

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