



# Automation & Digitalization in the Cranes Industry

Gerhard Fischer

10. November 2022

# Agenda

## 1

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### Modular Automation

Remote Operate Control System  
Load Collision Prevention  
Truck Positioning System

## 2

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### Trimodal Equipment Logistics System

Stack management  
Rail management  
Gate management  
Dangerous goods  
Open platform

## Presenter Gerhard Fischer



1983-1987 University Applied Science Munich

1988 Arizona State University, Tempe AZ

1989 German Military

1990 –1995 Siemens AG R&D

1995 –1998 Siemens Pte. Ltd. Singapore

1998 –2002 Siemens Ltd. Taiwan

2002 –2004 Siemens AG Germany

2004 –2008 Siemens Netherlands

2008 – Siemens AG Germany

### **Memberships:**

VDI AK304 „cranes“

DKE for IEC 60204-32

PEMA ED&I vice chair

IEEE industry applications society



# Evergreen Kaohsiung – 19 STS and 56 ARMG

## Full automation and digital twinning of the terminal

Project information	<ul style="list-style-type: none"><li>• Integrated automation, drive and control systems for 67 cranes</li><li>• Engineering, integration and optimization 22 ARMG + 6 STS by June 2022 18 ARMG + 5 STS by June 2023 16 ARMG + 8 STS by Jan 2024</li></ul>
Customer challenge	<ul style="list-style-type: none"><li>• High level of automation and digitalization</li><li>• Integration to in-house TOS</li><li>• “Future proofing” via modular and open concept</li><li>• Commissioning under Covid-19 impact (virtual commissioning)</li></ul>
Siemens solution	<ul style="list-style-type: none"><li>• Digital twinning in every aspect/phase of the project</li><li>• Remote Control Operating System and Remote Control Training Simulator</li><li>• Siemens Equipment Logistic System with TOS integration</li><li>• Simocrane modules: ARMG: RCOS, LCPS, FLS, SPMS, TPS, CLPS STS: RCOS, Sway Control, Vessel Profile Scanning, SPMS, TPS</li></ul>
Customer benefits	<ul style="list-style-type: none"><li>• State of the art automation technology</li><li>• Optimal equipment utilization</li><li>• Maximized availability</li></ul>



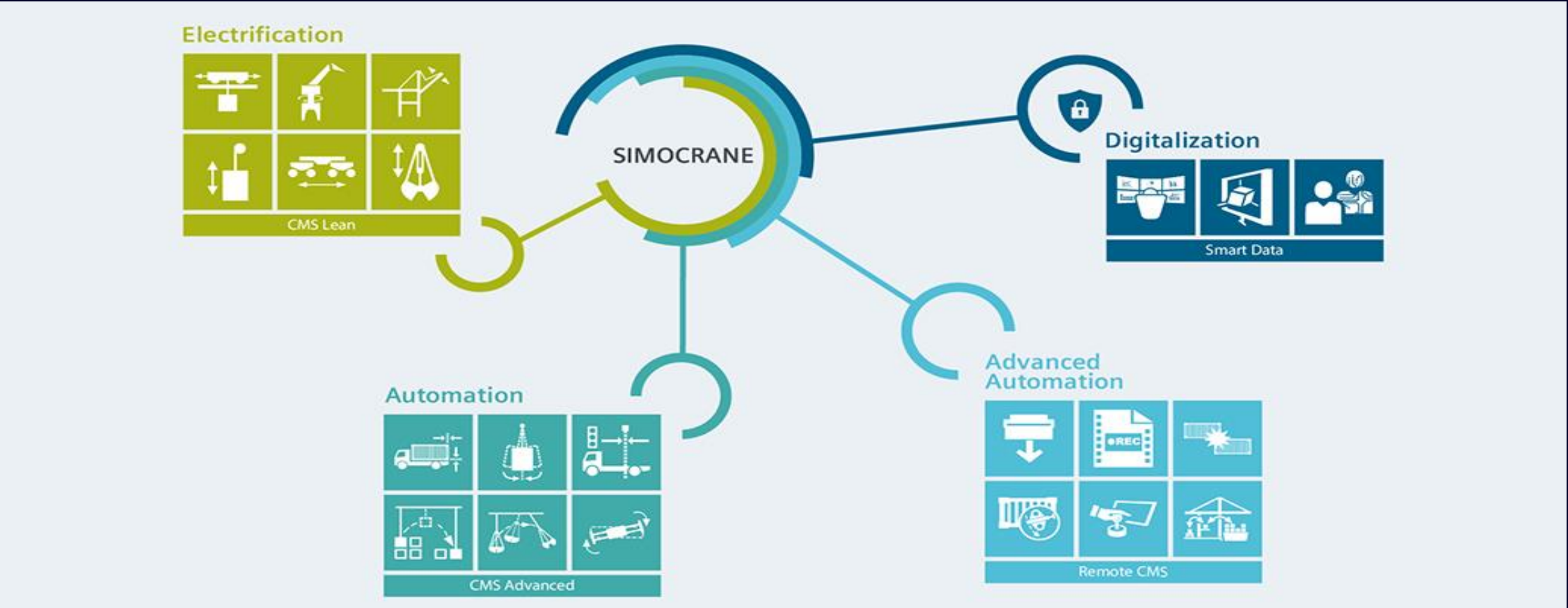
# Patrick Sydney 3 ARMG

Project information	<ul style="list-style-type: none"><li>• 3 ARMG</li><li>• Linking the container yard to the rail interface</li><li>• Straddle carriers as horizontal transport</li></ul>
Customer challenge	<ul style="list-style-type: none"><li>• Automatic rail car handling</li><li>• Personnel safety</li></ul>
Siemens solution	<ul style="list-style-type: none"><li>• Extensive use of digital twin &amp; simulation</li><li>• Cranes for train scan</li><li>• Simocrane modules RCOS, LCPS, FLS, OCR, CMS/RCMS, strad positioning</li></ul>
Customer benefits	<ul style="list-style-type: none"><li>• Versatility</li><li>• Operational consistence</li><li>• Remote crane driver comfort</li></ul>



# Modular Automation SIMOCRANE Trends

## Fully Modular Automation Solution for Terminals

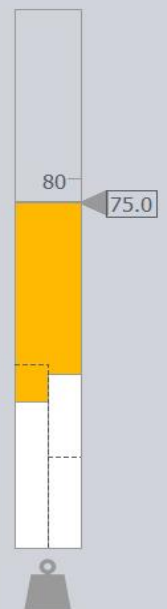
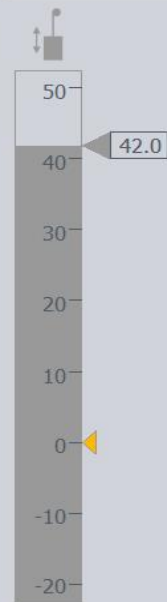
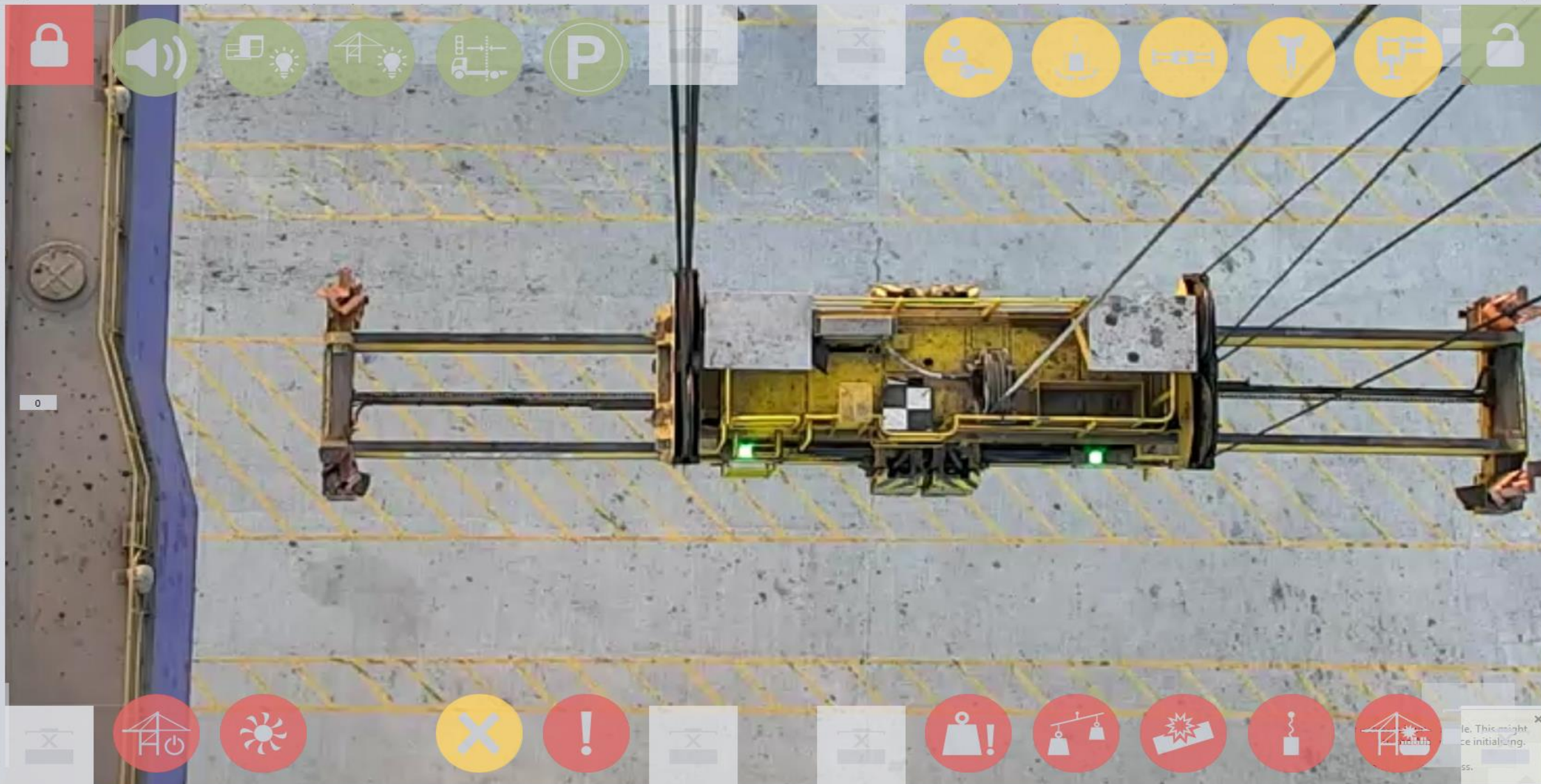




# Simocrane RCOS Remote Control Operating System







24 mm

20/20 ft

Trolley setpoint

Joystick 0%

0% Drive

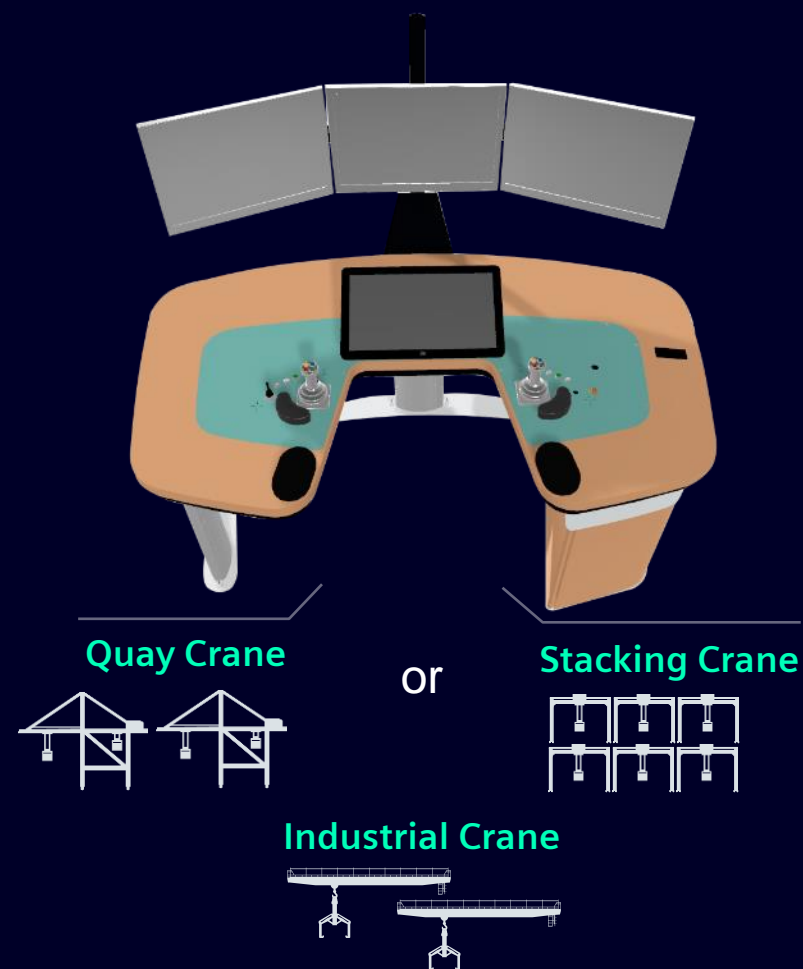
Hoist setpoint

Joystick 0%

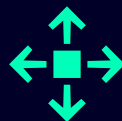
0% Drive



# Simocrane RCOS Functionality



**"Any to any"** operator connects to any crane from any desk.



**"Pooling"** connects crane to a free desk when assistance is needed

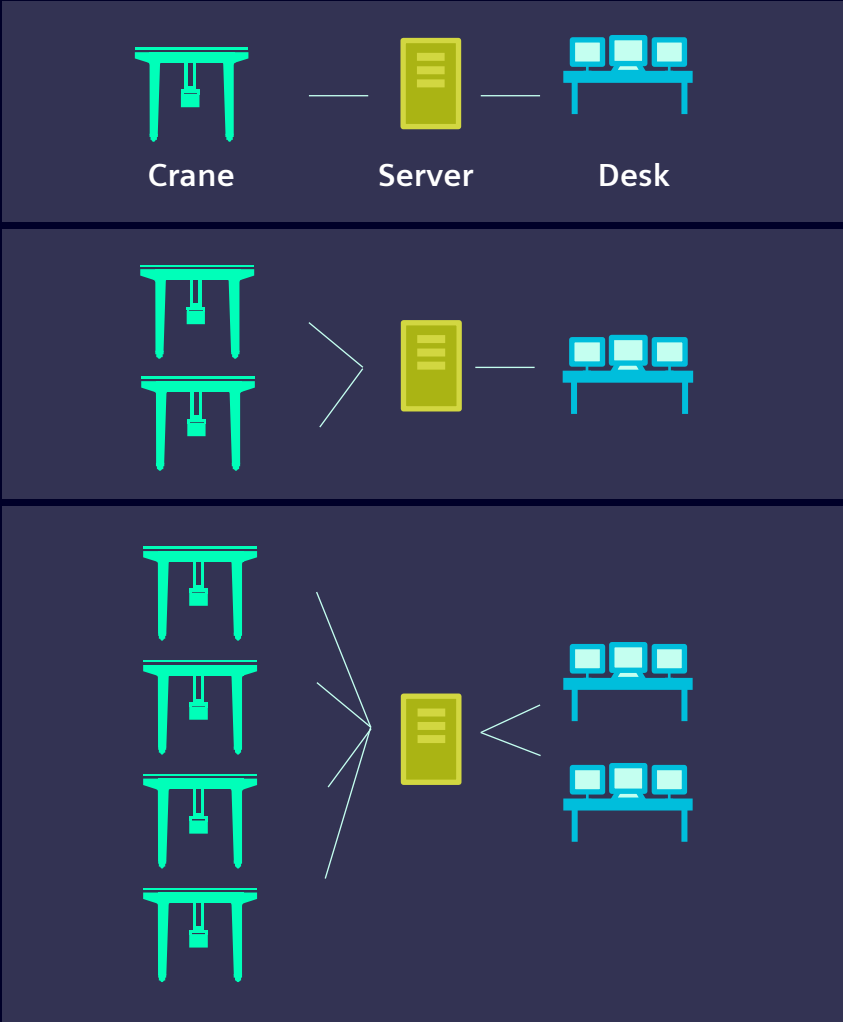


**"Decentral Concept"**  
Decentral PLC software

- Redundant Server Pair
- No single point of failure

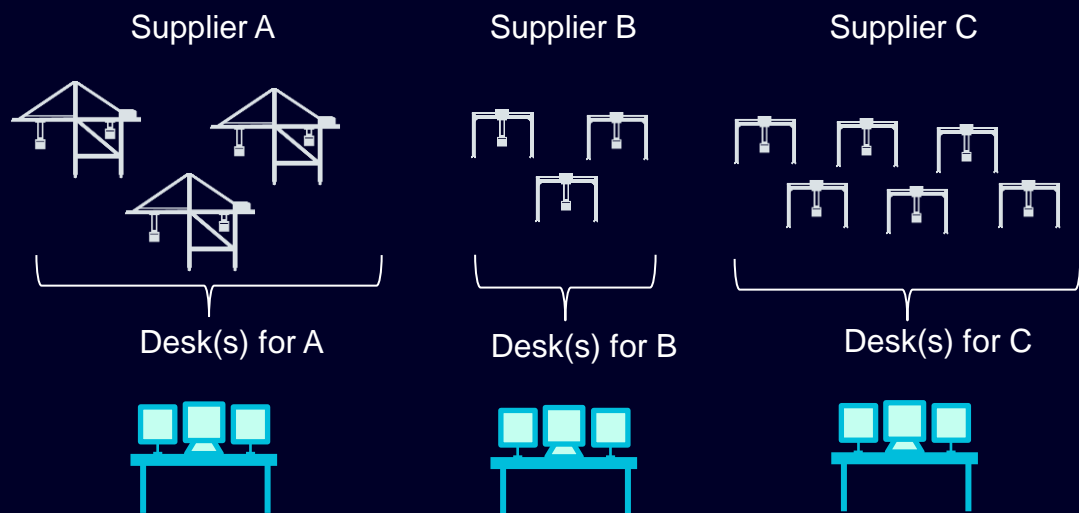


**"Integration & Interfacing"**  
can be applied to non-Siemens PLC's, offers interfacing with TOS



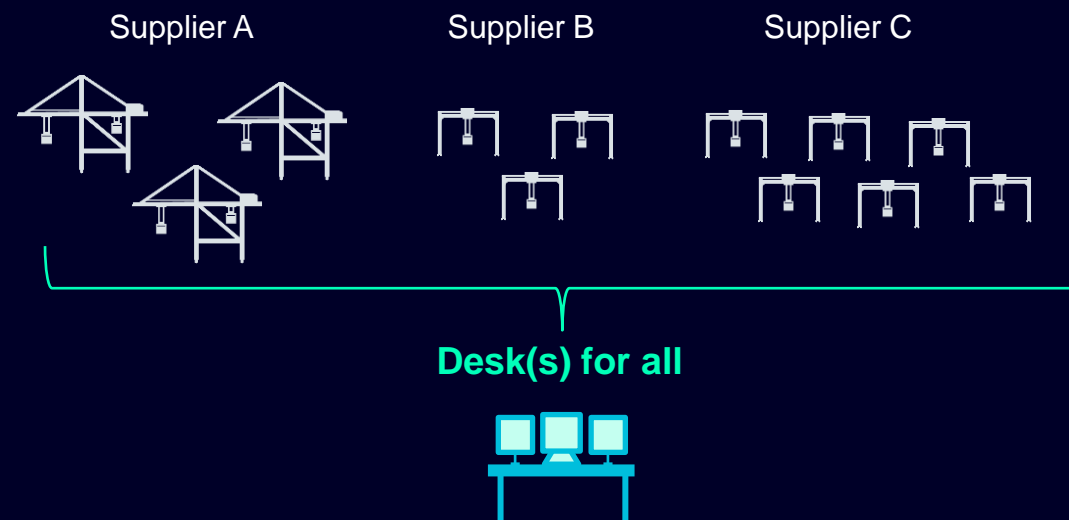
# Agnostic Remote Control

## Conventional solution



- End-user accepted proprietary solutions from different crane suppliers
- Desks of one supplier can only control cranes by this supplier
- No any-to-any possible
- No pooling of remote drives for whole fleet
- Multiple maintenance effort
- Higher complexity cybersecurity protection

## Crane supplier agnostic solution



- End-user specified to different crane builder Simocrane RCOS module
- Any crane is controllable from any desk
- Pooling of remote drives for whole fleet
- Single system to be maintained
- Best situation for cybersecurity protection







# Laser Sensor System TPS - Truck Positioning System

## Precise laser measurement system for accurate truck positioning

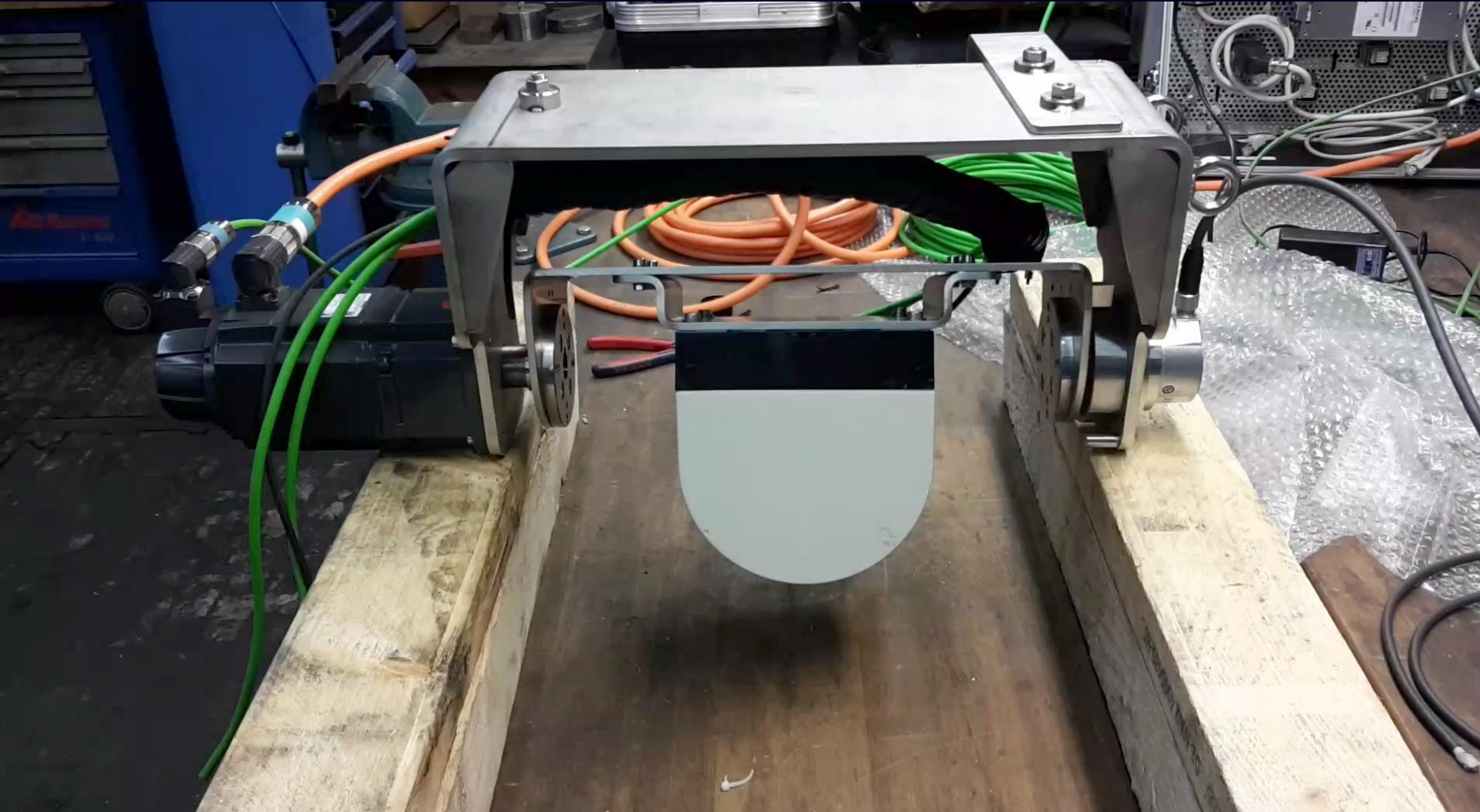
Laser measuring system provides position data from parameterized objects, trucks, trailers and containers.



Configuration and component selection can change during design



# Siemens 3D Laser Scanner Swivel Unit



## Performance

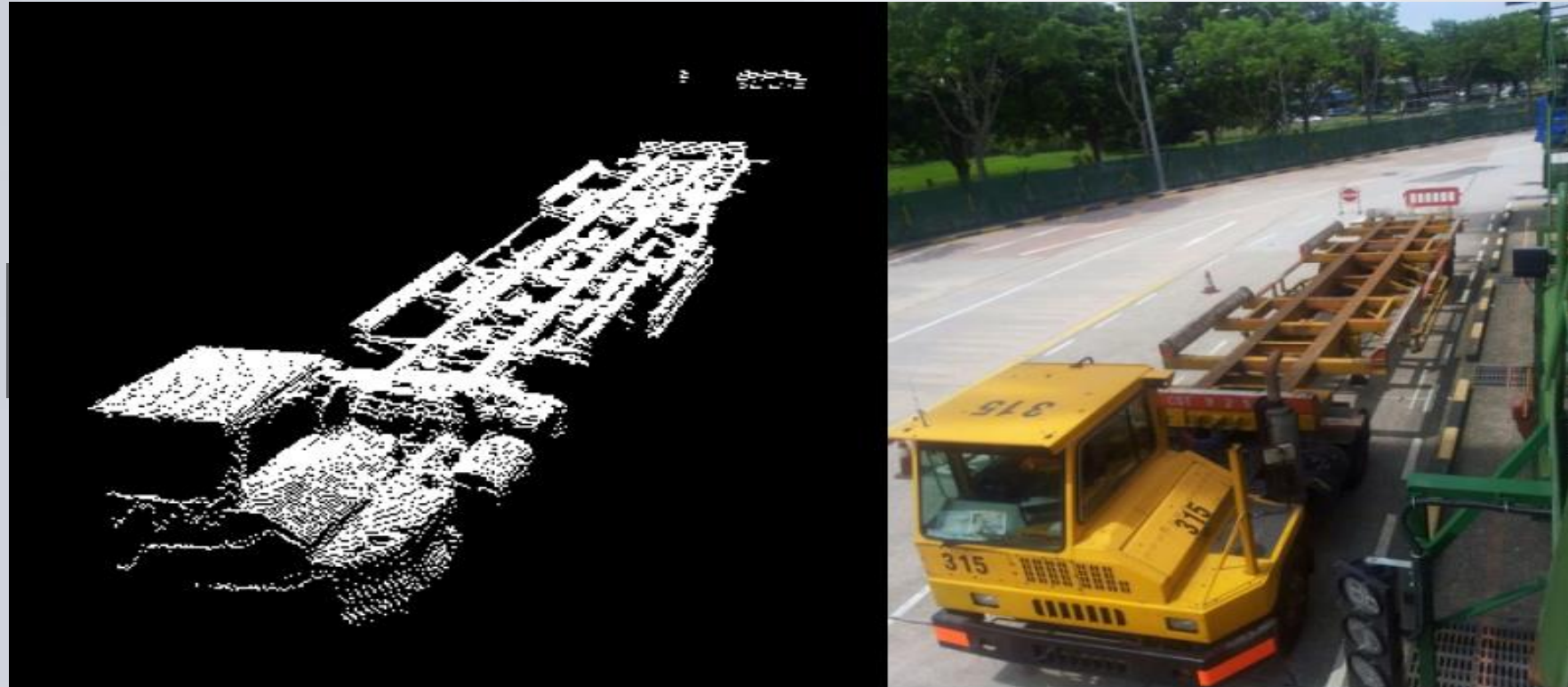
- +15% crane performance

## Technical info

- Gearless SIEMENS drive (Sinamics, 1FT6 servo)
- Double encoders option
- Encoder synchronized laser data
- Up to 40 degree/sec scan speed (from 5 deg/sec)

# Laser Sensor System TPS - Truck Positioning System

Cabin position monitoring  
with 3D laser measurement





# ELS – Intermodal TOS

## Stack management

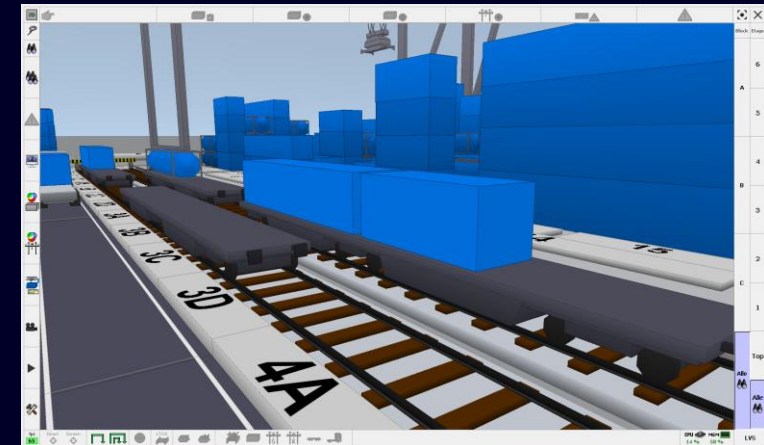
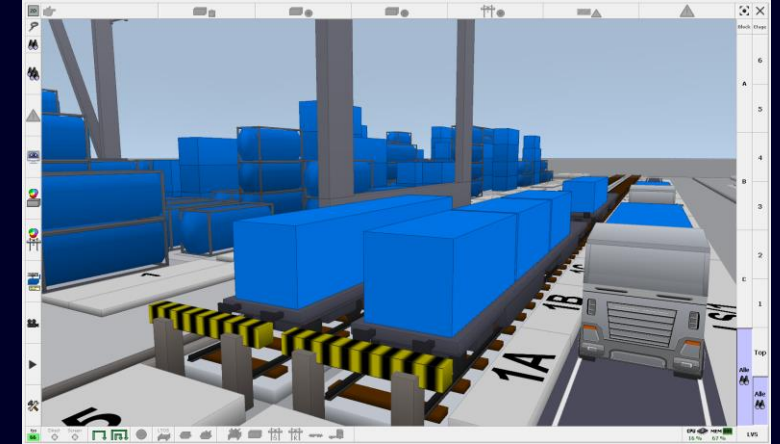
- ISO and tank containers, trailers
- Stack management bay-row-tier and mm-coordinates
- Location finding, based on
  - Container type and stacking rules
  - Weight
  - Physical restrictions
  - Expected time of departure (truck, train)
  - DGR-rules
- Housekeeping
- Automatic and/or manual activation of movements
- Inventory check functions



# ELS – Intermodal TOS

## Rail track management

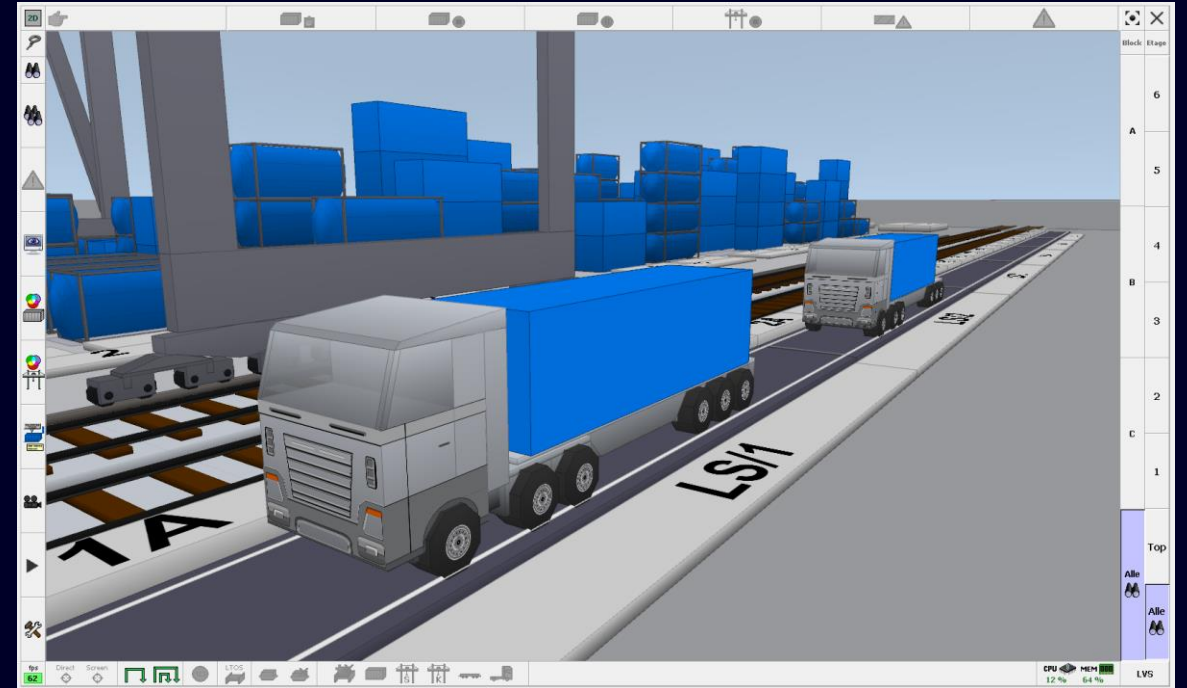
- Interface to commercial terminal management system / rail operator
- Train pre-announcement
- Verification after train arrival
- Inventory of wagons and containers
- Location based on sections or mm-coordinates
- Verification via OCR-interface
- Scheduling train loading, time supervision



# ELS – Intermodal TOS

## Gate interface, truck management

- Gate dialog functions or interface to gate system (to register trucks)
- Assign position for truck (loading lane / parking area)
- Call trucks from the parking area
- Align with crane operator in case of manual movement activation

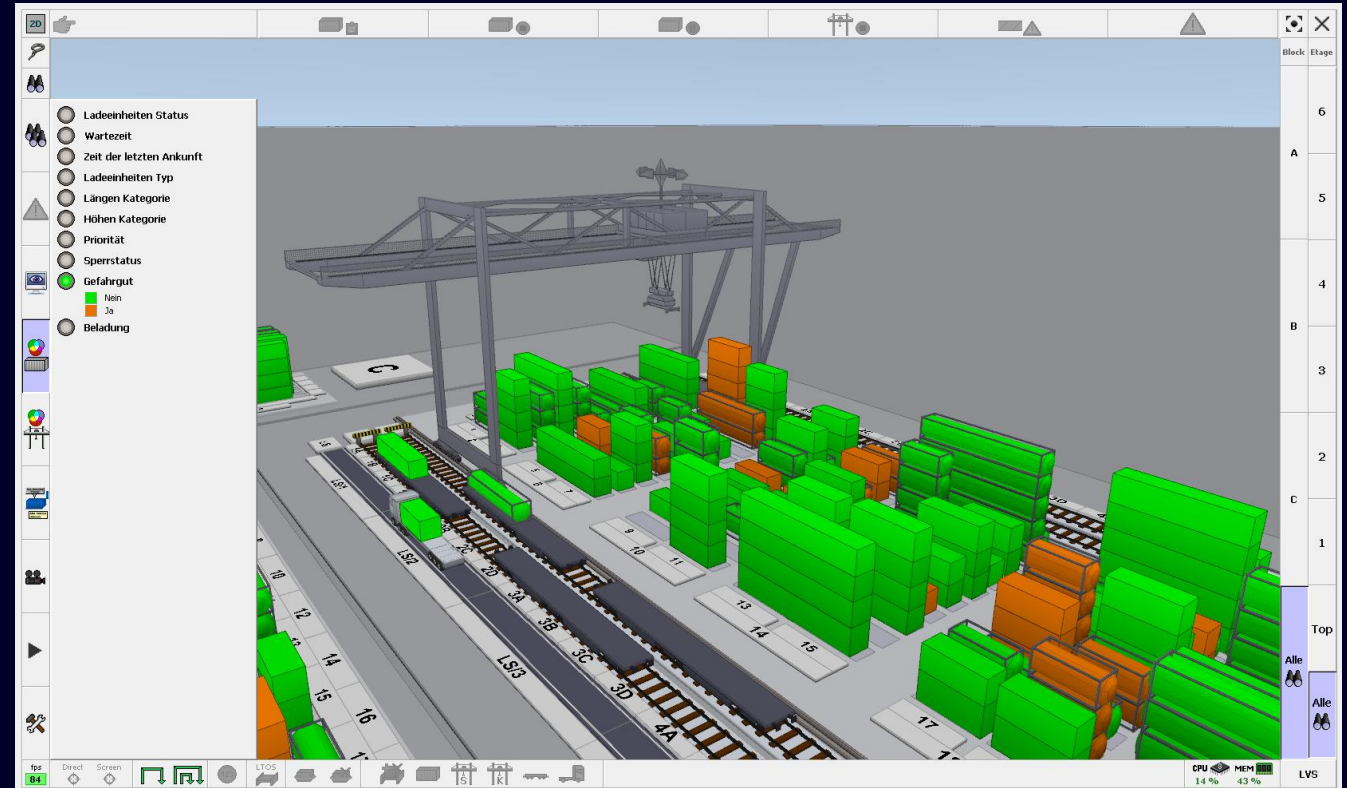




# ELS – Intermodal TOS

## Dangerous goods

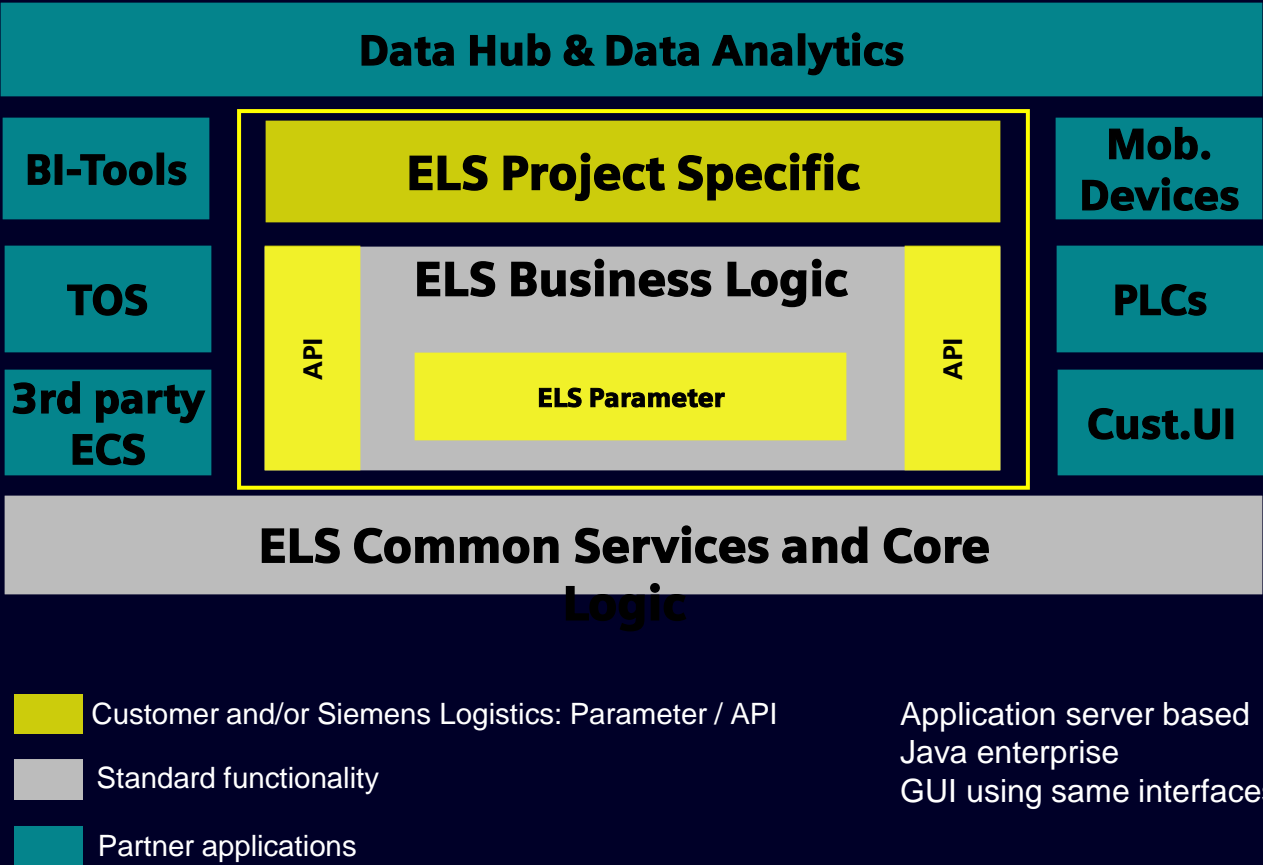
- Managing contents for DGR containers
- Mapping of contents into categories
- Rule sets for each category
  - Time rules
  - Distance rules
  - Quantity rules
  - Combination of these attributes
- Integrated in 3D visualization
- Mapping of national rules into categories  
=> international solution



# ELS – Platform Architecture

## Open Architecture

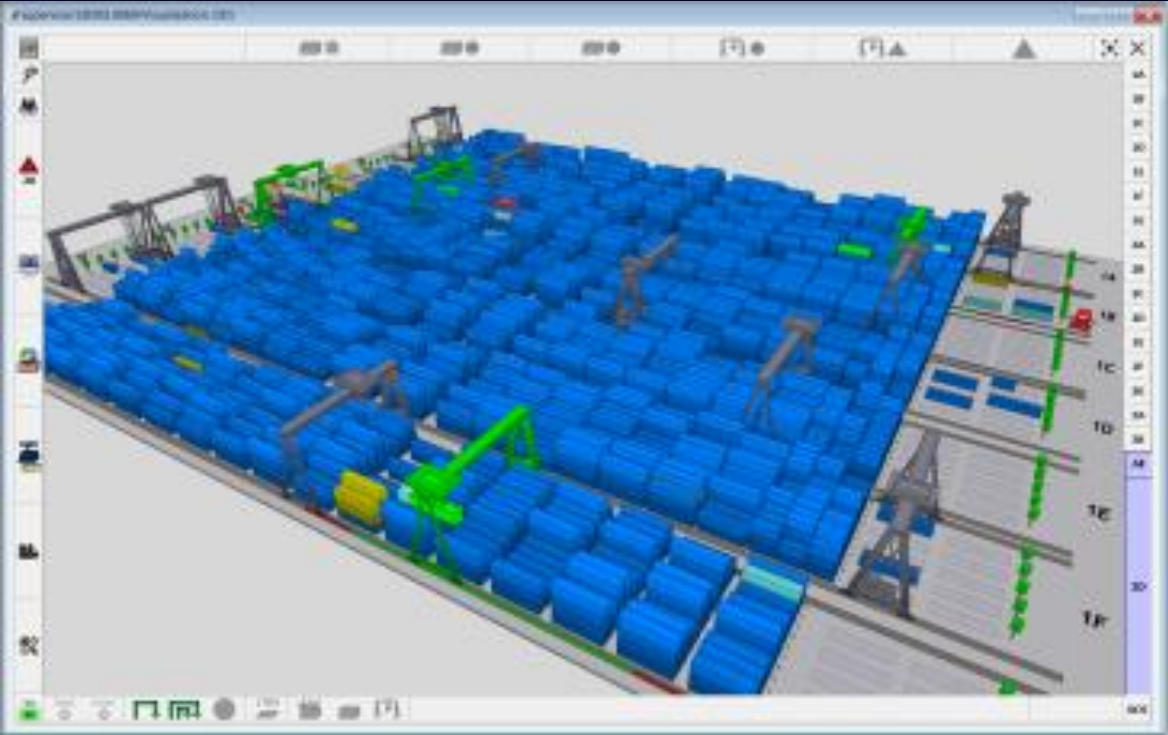
- Stable core functionality
- Business logic configured by parameters
- Open API, i.e. to TOS, PLCs, HT, BI, Data Warehouse, ...
- APIs can be used by other ECS or customer UI
- Project specific part planned to be fully open



# Data Warehouse and Data Analytics

## Derivation key KPI

e.g. crane, block, transfer zone utilization





# Equipment Logistics System

## Example Brownfield Integration of a Block

### Typical setup in a brownfield terminal

- Existing TOS, i.e. Navis, Cyberlogitec, Tideworks, ...
- Existing PLC-System for equipment, Siemens Simatic S7 or 3<sup>rd</sup> party PLCs
- Existing middleware as interface exchanger with less/no logistical logic

### Integration in a brownfield terminal

- Standard interfaces (APIs) to TOS and PLC
- Option: Interface transformer if required
- Individual transformers to connect existing environment to ELS

