Desenvolvimento de veículos autónomos com **SIMOVE** e Plataformas de gestão e orquestração de frotas **AGV/AMR**

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Flexible production
with AGV and AMR

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Rethinking production towards more adaptability
From fixed production lines to autonomous production

Fixed production lines

accelerated to

Adaptive, modular production lines

towards

Autonomous production

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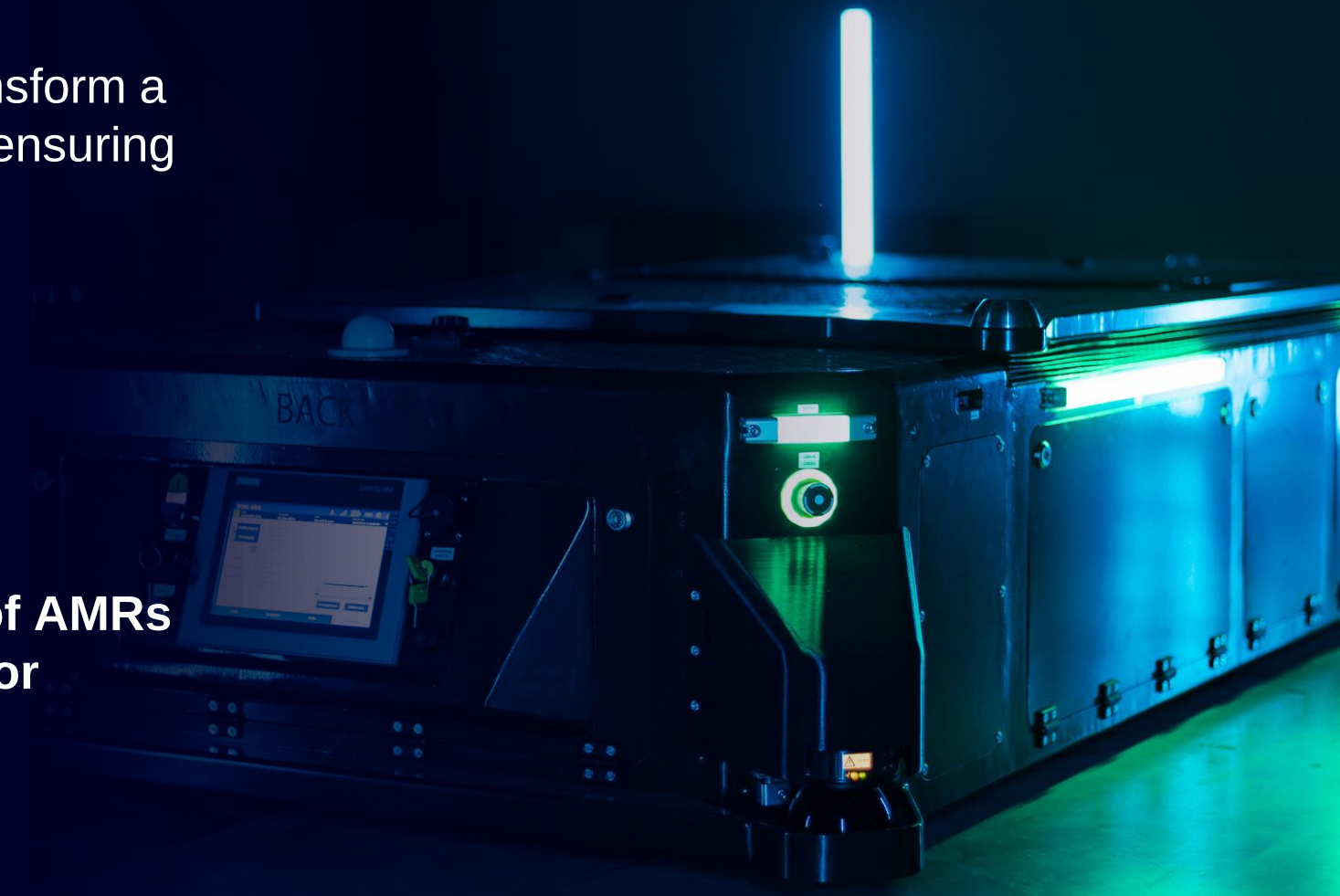
One solution for these challenges is to transform a static production line to a dynamic one by ensuring flexible material flow with AMRs

What is often overlooked,

is interoperability and standardization of AMRs with production and IT systems is key for flexible production.



Siemens offers a system platform designed specifically for AGVs

INTEGRATION

Open interfaces
- No know-how protection
- Easily extendable
- Easily customizable

STANDARDIZED COMMUNICATION

Proven standards
- Profinet
- Open user communication
- VDA 5050

SCALABLE & MODULAR

Flexible approach
- For every use case, from basic to advanced
- Modular architecture
- 3rd party integration

INTEGRATED SAFETY

Failsafe features
- Laser scanner
- Emergency stop
- Failsafe drive functionality

COMPREHENSIVE SOFTWARE & HARDWARE APPROACH

Holistic solution
- Recommended hardware architecture
- PLC library

DOMAIN KNOW-HOW

Core technology
- Automation know-how
- Drive technology know-how

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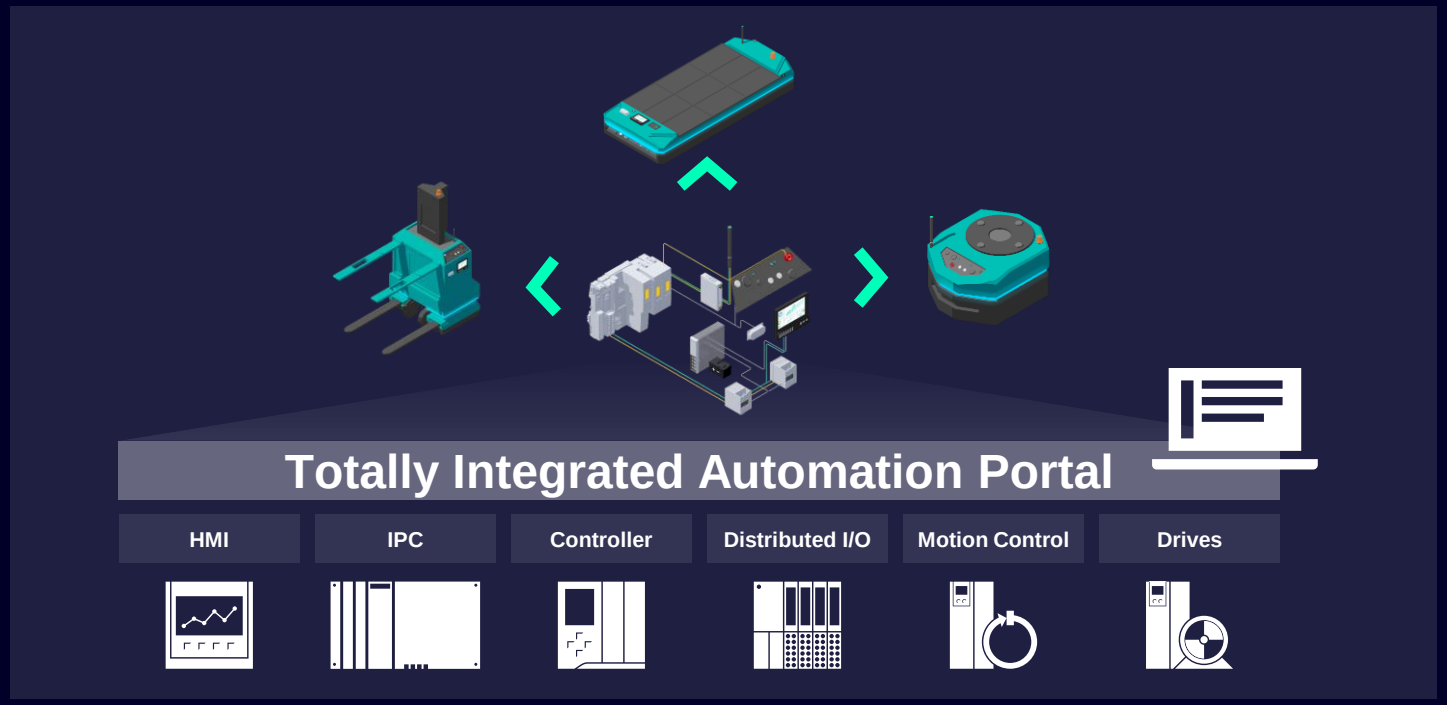
Scalable and modular automation architecture **based on standard components** with TIA Portal



- Security integrated
- Safety integrated
- Diagnostics
- Energy Management

Solution

AGV&AMR automation architecture
Standardization simplifies development!

Scalable hardware portfolio with integrated security, safety, diagnostics and energy management.

TIA Portal – One engineering tool for all automation, motion control & safety tasks

Modular automation architecture for various types of AGV and AMR applications

- Exemplary BOM covering essential automation and drive components
- System approach with seamlessly integrated features and functions across all components
- Standard products with widespread adoption in the industry and global availability and support

Predefined system architectures ensure compliance with global regulations and minimize certification efforts

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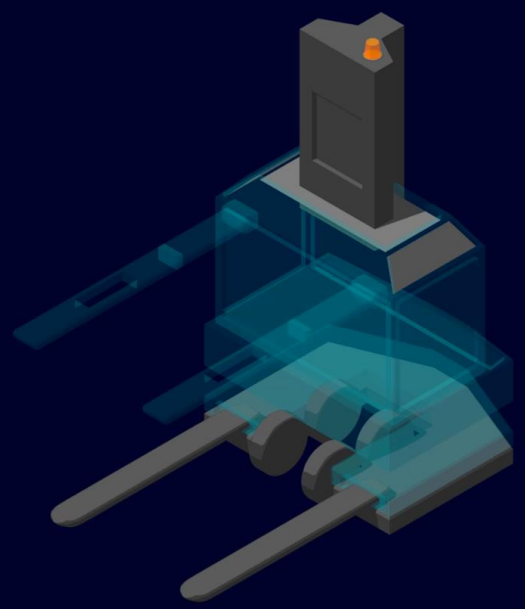
Scalable and modular automation architecture based on standard components with TIA Portal



Demonstration

Reliability and durability are key aspects of AGV and AGV systems in production environments so their automation components must meet the highest industry requirements.

The so-called **SIMOVE architecture** uses standard products from the **TIA portfolio** that are available worldwide and have proven themselves in all industries.

The automation architecture is scalable across a wide range of AGV and AGV types. In addition, the architecture can be easily adapted to project-specific requirements thanks to its open and modular design.

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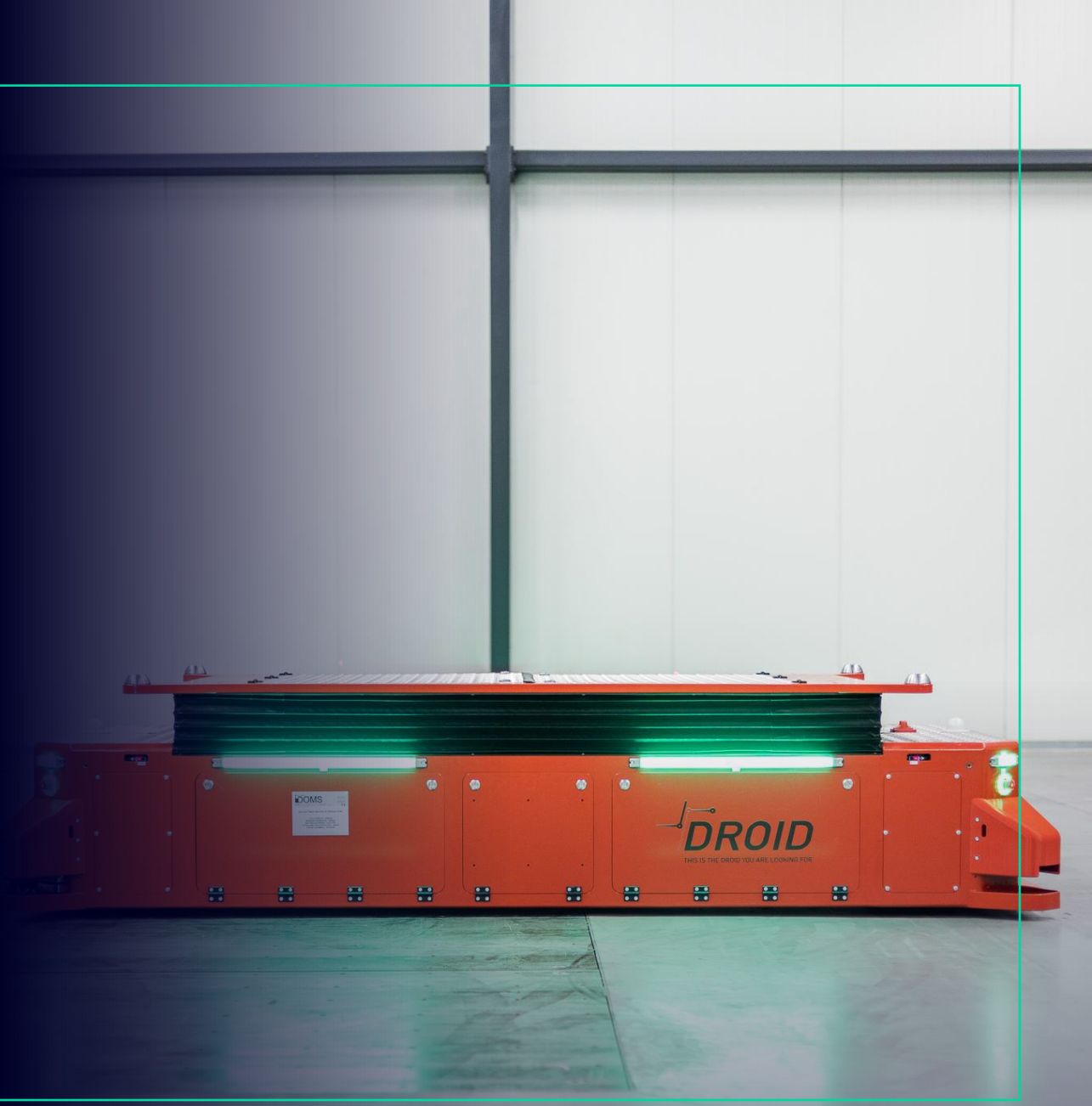
How is an AGV controlled with SIMOVE?



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Standardization in AGV and AMR system software
With SIMOVE

Custom extension
Project specific
Customer specific
Open system

SIMOVE Master Control
Fleet control
Fleet visualization
Traffic Control

SIMOVE ANS+
Natural navigation
Obstacle avoidance
SLAM

SIMOVE Carrier Control
AGV/AMR control
Line guidance
Safety

Solution

SIMOVE consists of 3 modules that are seamlessly integrated in the design and function independently of each other. This also allows for customer specific extension.

It is a comprehensive, scalable and modular system package, which empowers manufacturers to tailor AGV and AMR applications precisely to the end customer's requirements.

Built upon Siemens' standard products, SIMOVE technology utilizes an automation architecture (BOM) and standardized software modules for diverse AMR types, covering automation, navigation software, and fleet control.

A standardized look & feel and seamless diagnostic facilitate operation, maintenance, and diagnostics, allowing AGV manufacturers to leverage basic Siemens automation know-how with ease.

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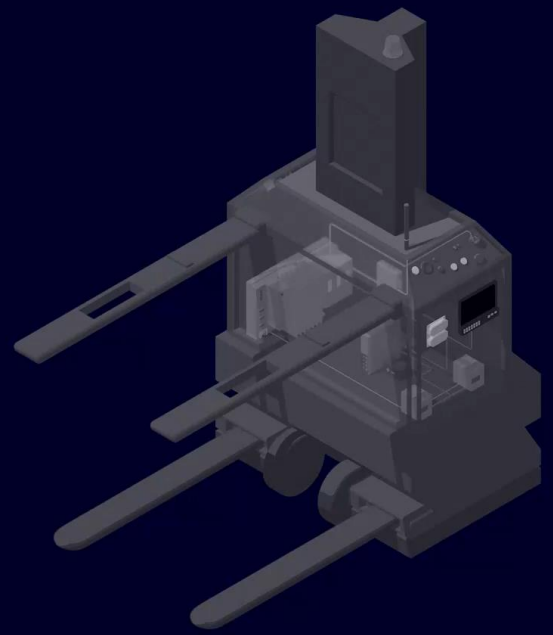
Standardization in AGV and AMR system software
With SIMOVE



Technical Solution

The SIMOVE Carrier Control is an automation library and application example, for the basic functionality of an AGV/AMR automation. It enables AGV manufacturers to automate an AGV/AMR and easily extend it with own functionalities.

SIMOVE ANS+ is a laser based natural navigation software, which includes a sophisticated route and map management and autonomous capabilities.

With SIMOVE Master Control manufacturers can build their own traffic and fleet control for AGV and AMR via PLC. With proven application examples MES systems connectivity can be easily implemented, as well machines and robot cells can be seamlessly integrated with functional safety.

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SIMOVE

Carrier Control

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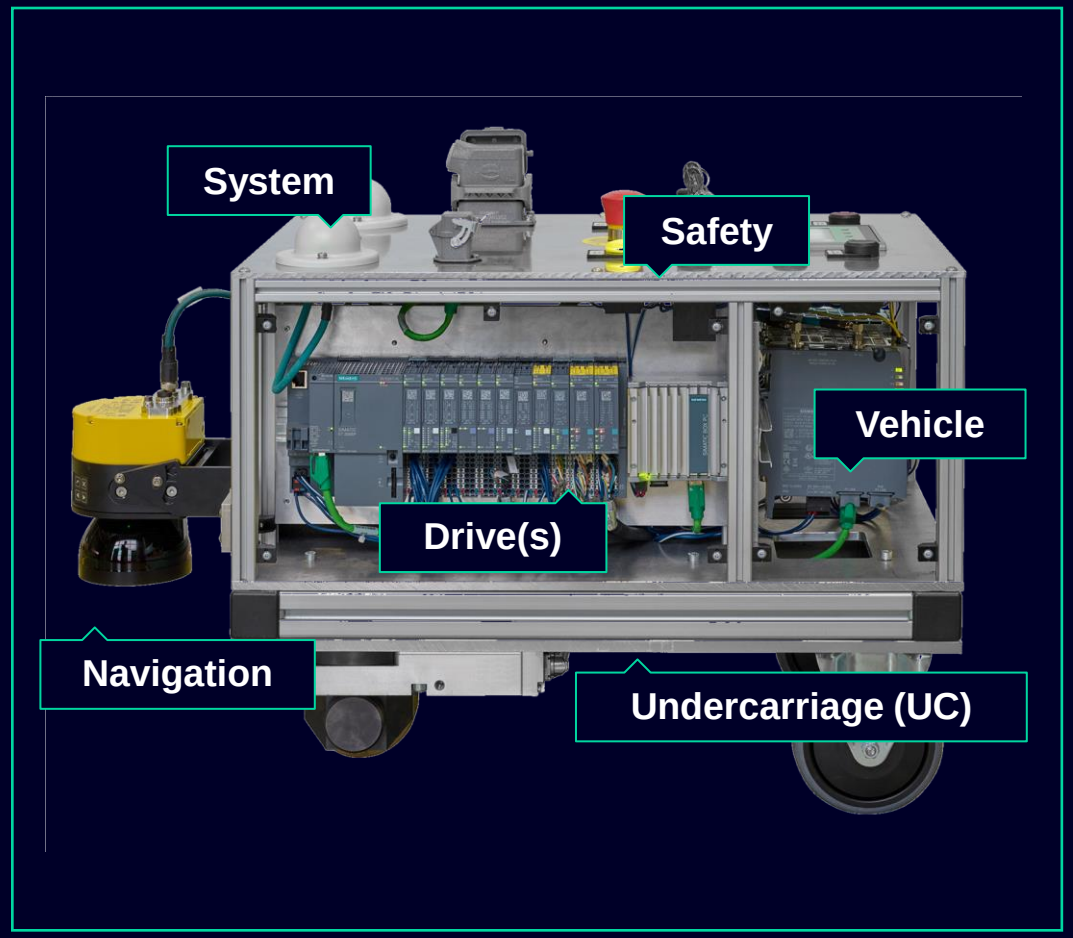
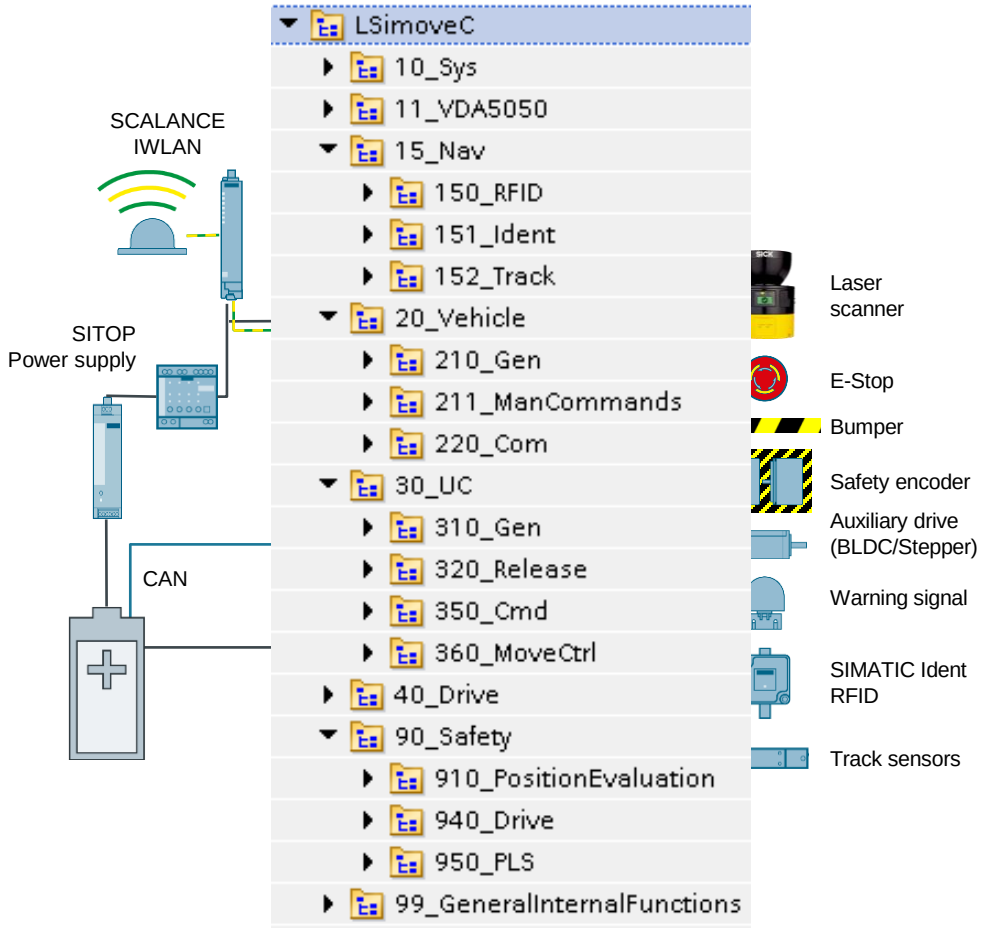
Automation portfolio for AGVs
Hardware architecture with the essential components





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Navigation system ANS+

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SIMOVE ANS+

ANS+

is an industrialized standalone navigation software with a standardized interface to the Carrier Control which provides navigation features for track guidance and localization.

Localization

- Feature-based SLAM (Simultaneous localization and mapping)
- Use of 2D environmental outlines (if necessary, supplemented by reflector markers)
- Support of different laser sensors up to an amount of four

Navigation

- Follows virtual path
- Based on pre-defined routes within the digital map
- Engineering tool for mapping, layout configuration, parametrization and deployment

Vehicle

- Open interfaces via TCP or UDP to Carrier Control
- Virtual track sensor interface provides a virtual track deviation to the Carrier Control
- Pilot interface: provides common velocity from ANS+ via user interface (e.g., SIMOVE Control App)

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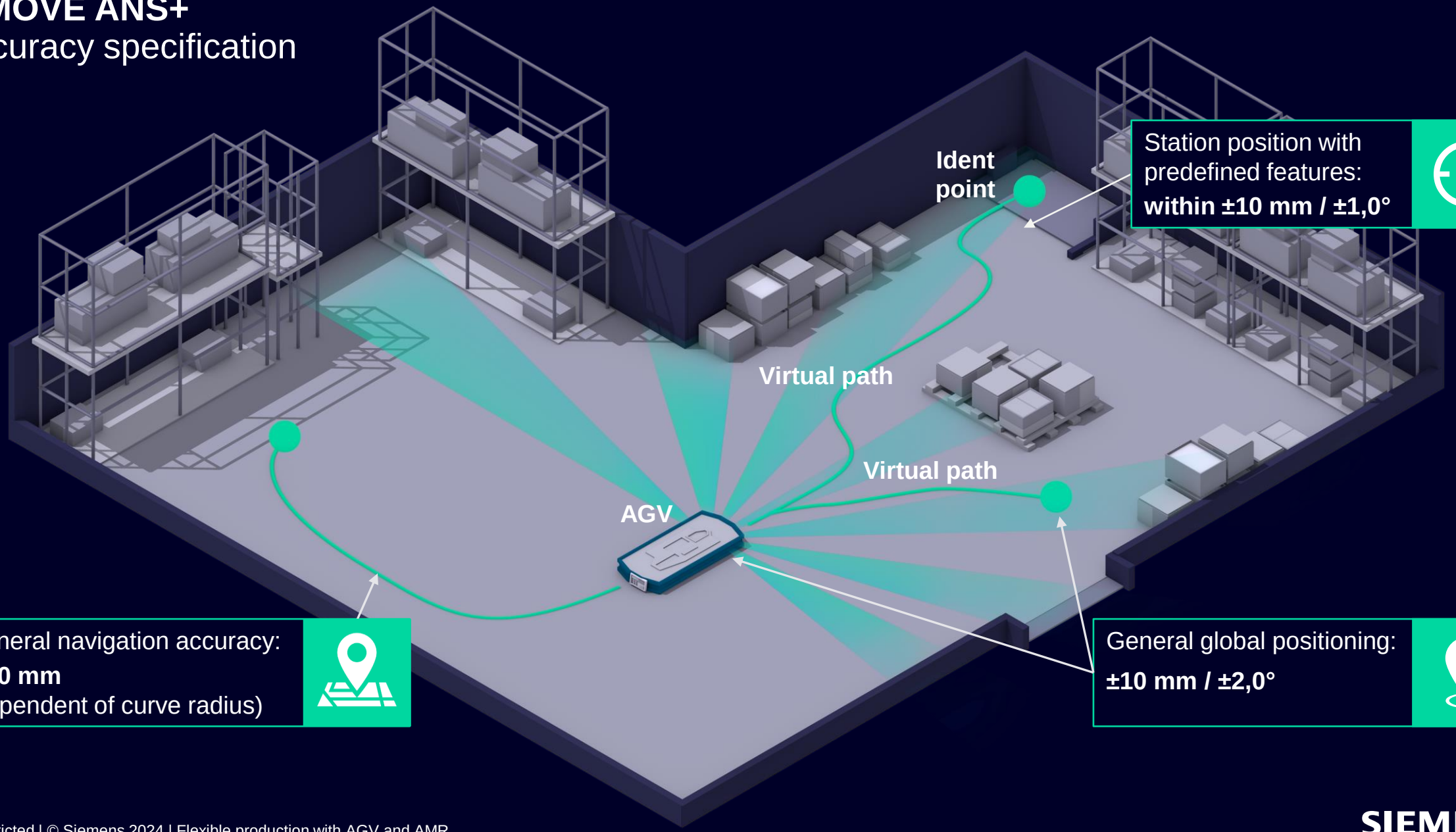
SIMOVE ANS+
Accuracy specification



Station position with predefined features:
within ±10 mm / ±1,0°

General navigation accuracy:
± 50 mm
(dependent of curve radius)

General global positioning:
±10 mm / ±2,0°

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SIMOVE supports a wide array of use-cases

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Use case
Incoming Goods

Until now

Established technology: forklift truck

Competitive edge with SIMOVE

AGVs equipped with SIMOVE reduce personnel costs and increase the efficiency by unloading trucks

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Use case
Picking

Until now

Normally done manually

Competitive edge with SIMOVE

- “Goods-to-person” is the up-to-date method of order fulfillment for accurate picking processes
- Products are automatically transported directly to the operator as needed for picking

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Use case
Storage

Until now

With rigid automation or manually

Competitive edge with SIMOVE

- Automated storage for higher efficiency and transparency
- The AGV can deliver material to an automated handover station
- Can be combined with other automated storages and retrieval systems (AS/RS) or shuttle systems

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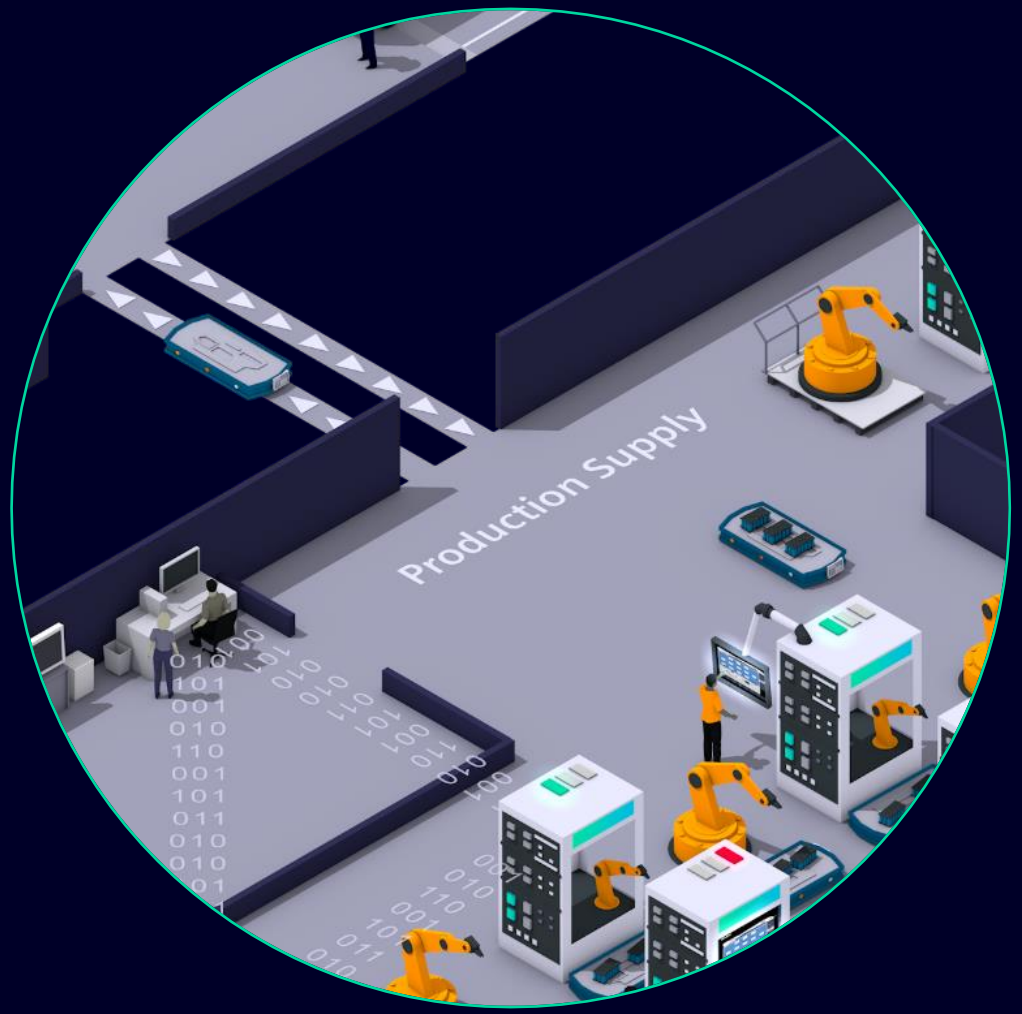
Use case
Production supply



Until now

Traditionally done manually with the risk of errors

Competitive edge with SIMOVE

- The material supply is flexible and efficiently automated with AGVs
- AGV system is fully integrated in smart production process

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Use case
Production

Until now

Conventional production logistics is rigid and sensitive to changes

Competitive edge with SIMOVE

- The future architecture of production is flexible and less fixed
- To fulfill this flexibility and modularity, the product can be assembled or directly fabricated on the AGV

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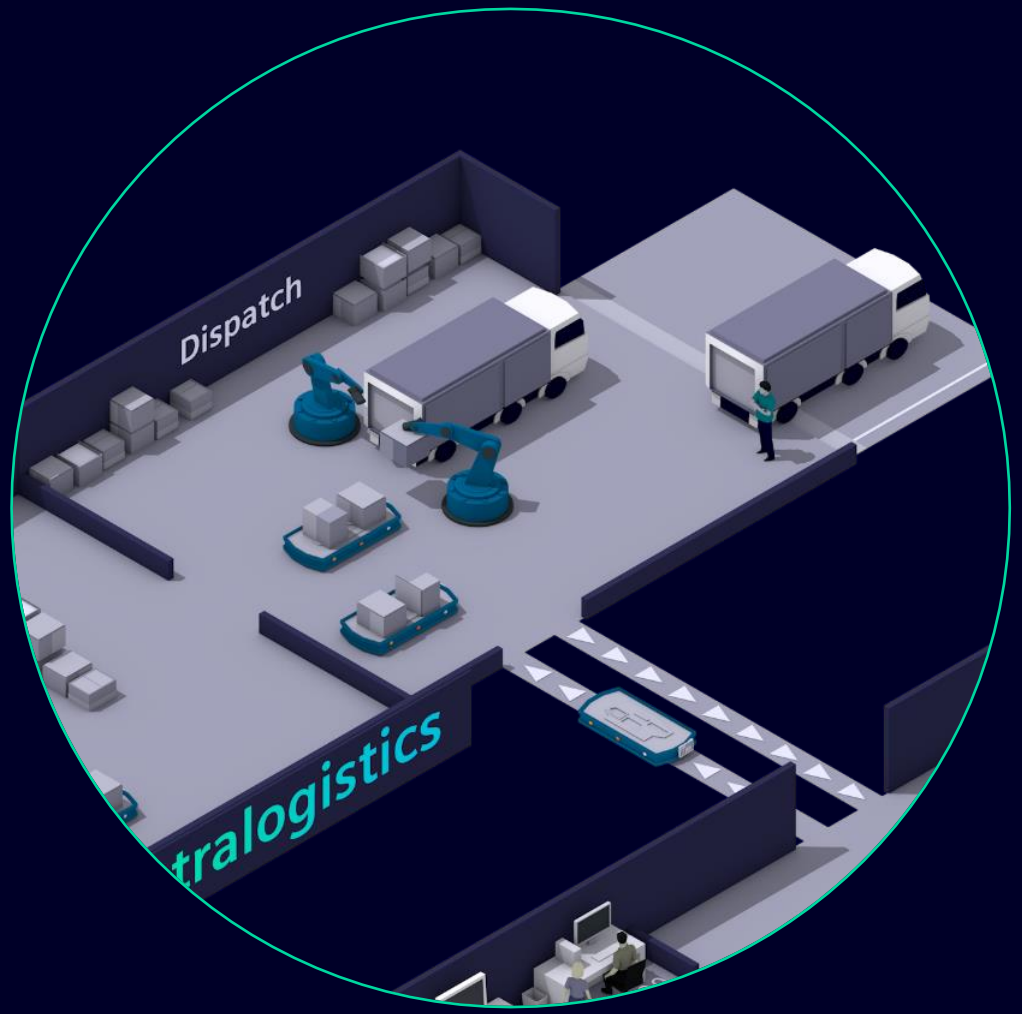
Use case
Dispatch



Until now

Established technology: forklift truck

Competitive edge with SIMOVE

- AGVs equipped with SIMOVE reduce personnel costs and increase the efficiency loading trucks

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AGV – Automated Guided Vehicles
Typical AGV Applications

Material Transport

Tugger Train

Underneath Trolley

Manufacturing AGV

Car Body Transport

Passive Load Carrier

Handling AGV

Active Load Carrier

Mobile Robot

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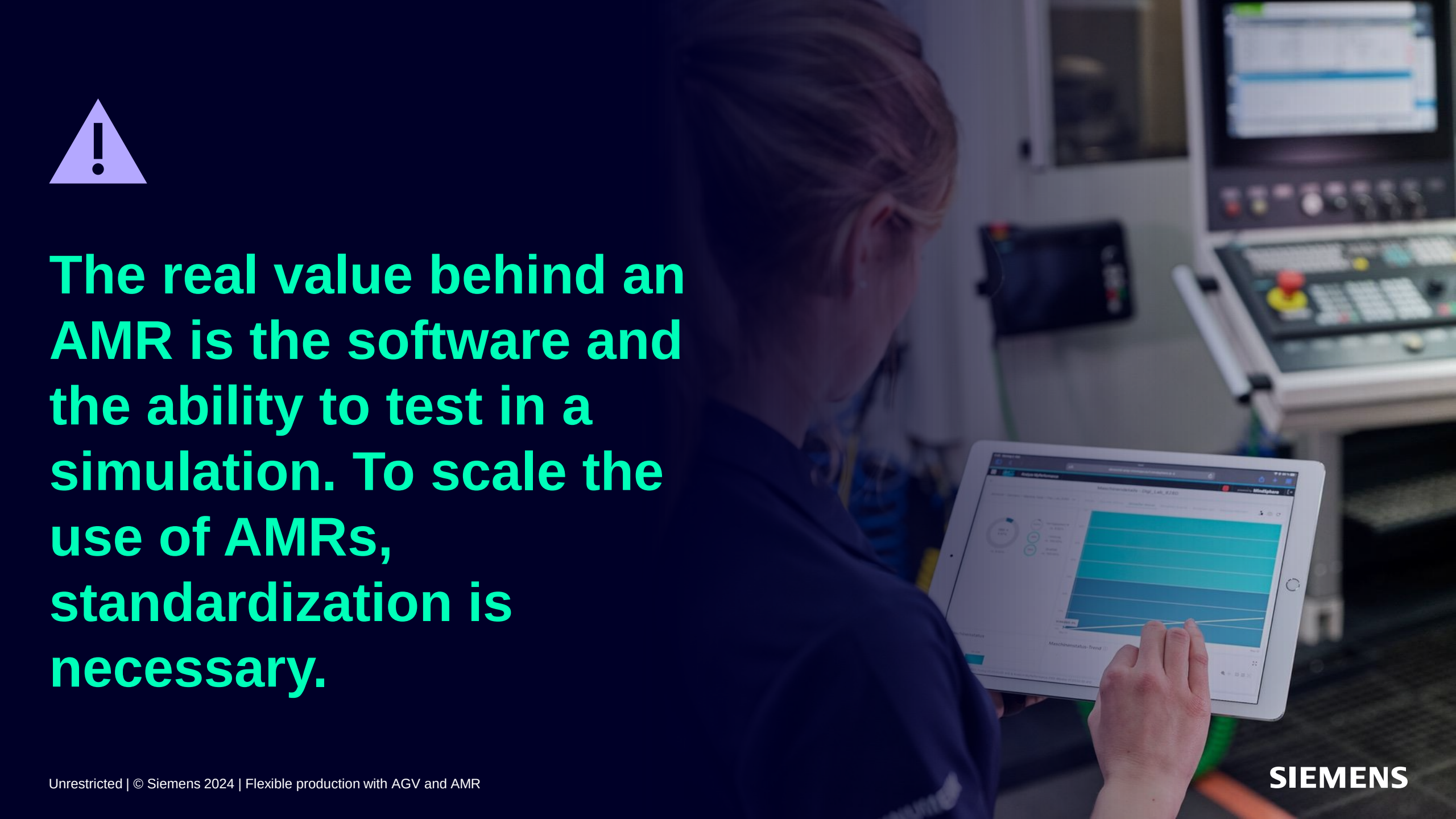
The real value behind an AMR is the software and the ability to test in a simulation. To scale the use of AMRs, standardization is necessary.



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How to ensure flexible production with ARMs

Planning and Simulation

Optimizes throughput and **efficiency** creating transparency for informed investment decisions. **Validate** mechatronic systems and ensure **seamless collaboration** through **integrated data** across all planning phases.

Fleet automation and commissioning

Higher standardization level between **logistic** and **process machines**.

Reducing engineering and commissioning **efforts** and **risks** complying with safety standards.

Fleet integration

Integrate new fleets to existing systems faster using open and proven standards.

Ensure **machine interoperability** and **minimize operational** and **maintenance costs**.

Fleet orchestration

Orchestrate complex and heterogenous fleets.

Gain supplier independency while ensuring seamless interoperability between fleets and enhancing process transparency.

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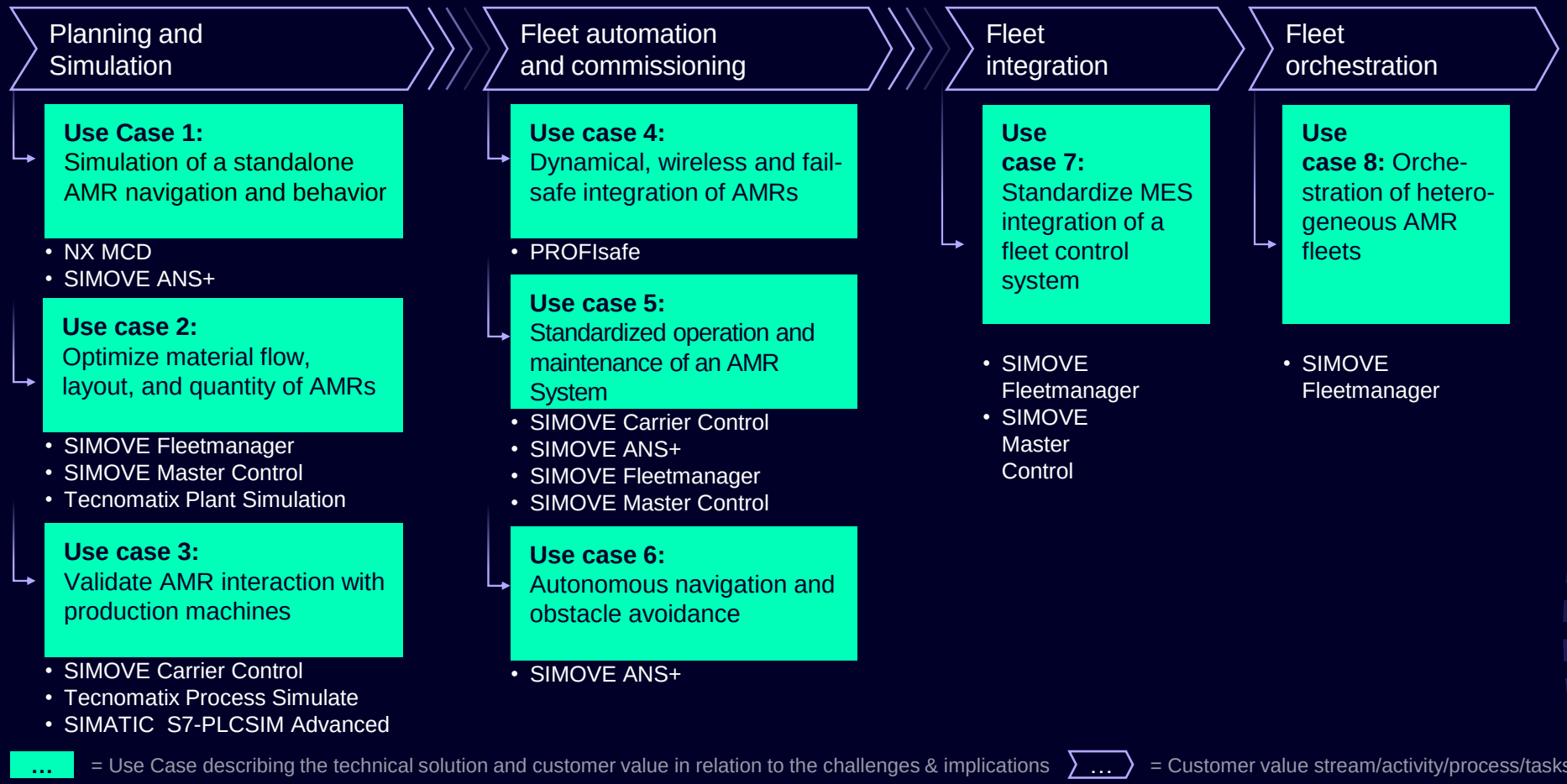
Siemens offering to ensure flexible production with AGV and AMR

Use-Case and Portfolio Overview



… = Use Case describing the technical solution and customer value in relation to the challenges & implications

… = Customer value stream/activity/process/tasks

- Simulation of standalone AMR navigation and behavior
- Optimize material flow, layout and amount of AMRs
- Validate AMR interaction with production machines
- Wireless and fail-safe integration of AMRs
- Standardized operation and maintenance of an AMR System
- Autonomous navigation and obstacle avoidance
- Standardize MES integration of a fleet manager
- Orchestration of heterogeneous AMR fleets

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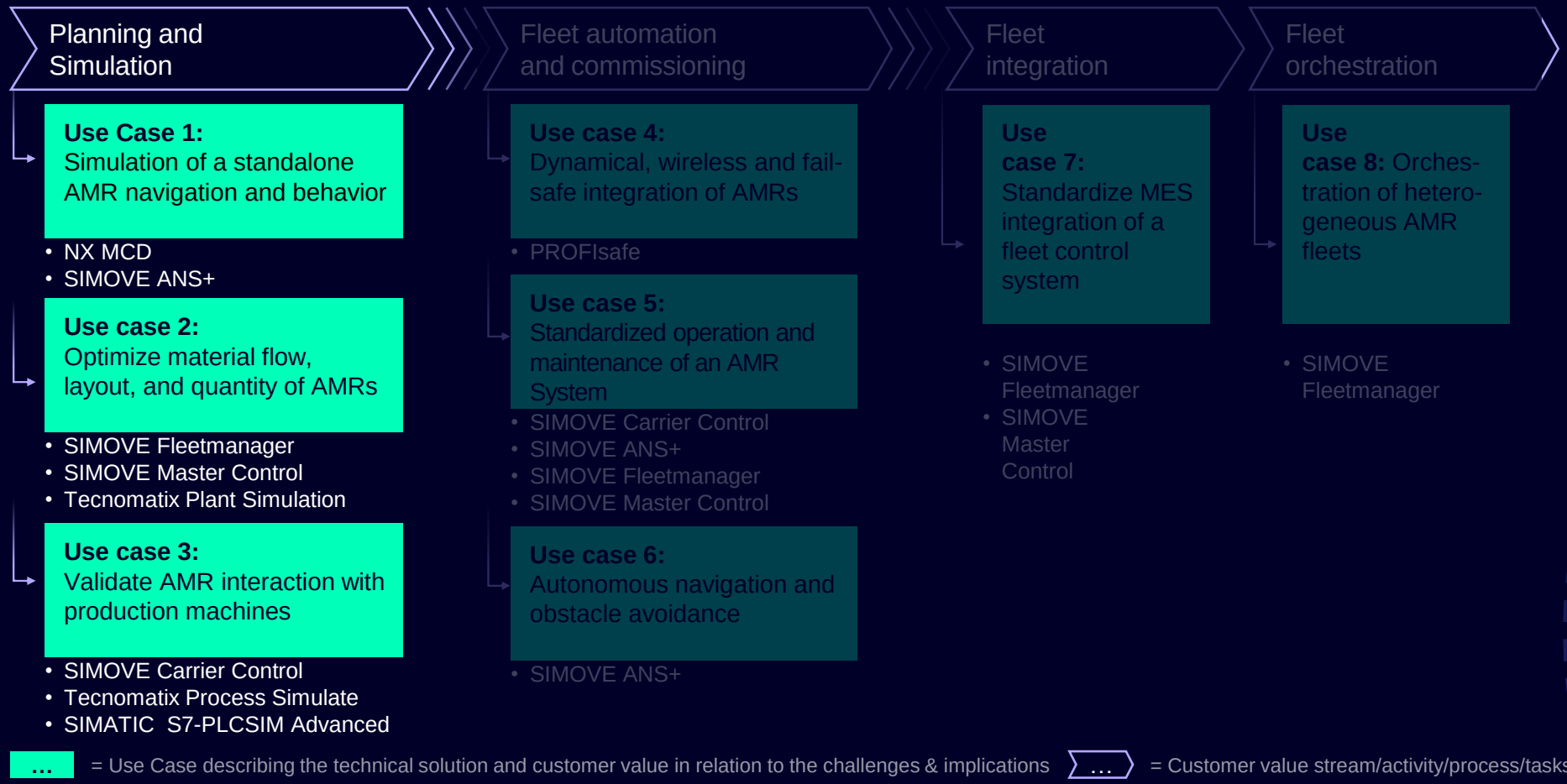
Solution Map

Use-Case and Portfolio Overview



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Simulation of a standalone AMR navigation and behavior
How to use virtual commissioning to optimize an AMR

Use Case scenario within lifecycle

- Machine Builder is engineering a new AMR, including mechanical design, electrical and automation engineering
- Automation should consider all components of the electrical engineering into consideration, especially navigation, drives, kinematics, sensors, safety etc.
- Different configurations should be tested with high dependencies between the different disciplines and typically uses physical prototypes for integration

Challenge

- Unwanted behavior results from the not considered interaction of mechanical design and automation code
- Effects of automation on AMR cannot be tested without physical machine
- Long iteration cycles/waste due to physical prototyping
- Risks of damages, physical harm or limitations of testing when using physical prototypes

Planning and simulation

TOPIC 1 | Simulation of standalone AMR navigation and behavior

TOPIC 2 | Optimize material flow, layout and quantity of AMRs

TOPIC 3 | Validate AMR interaction with production machines

SIEMENS

Simulation of a standalone AMR navigation and behavior
With SIMOVE Carrier Control, TIA Portal, NX MCD, SIMIT and SIMATIC S7-PLCSIM Advanced

Solution

An AMR can be automated with ANS+ and the SIMOVE Carrier Control function library in TIA Portal based on standard automation and drive components.

The full AMR behavior is simulated and validated in a 3D environment by combining NX MCD with SIMIT and running the real PLC code in SIMATIC S7-PLCSIM Advanced.

Simulating movements and validating proper functioning of the collision detecting are essential steps to ensure smooth commissioning.

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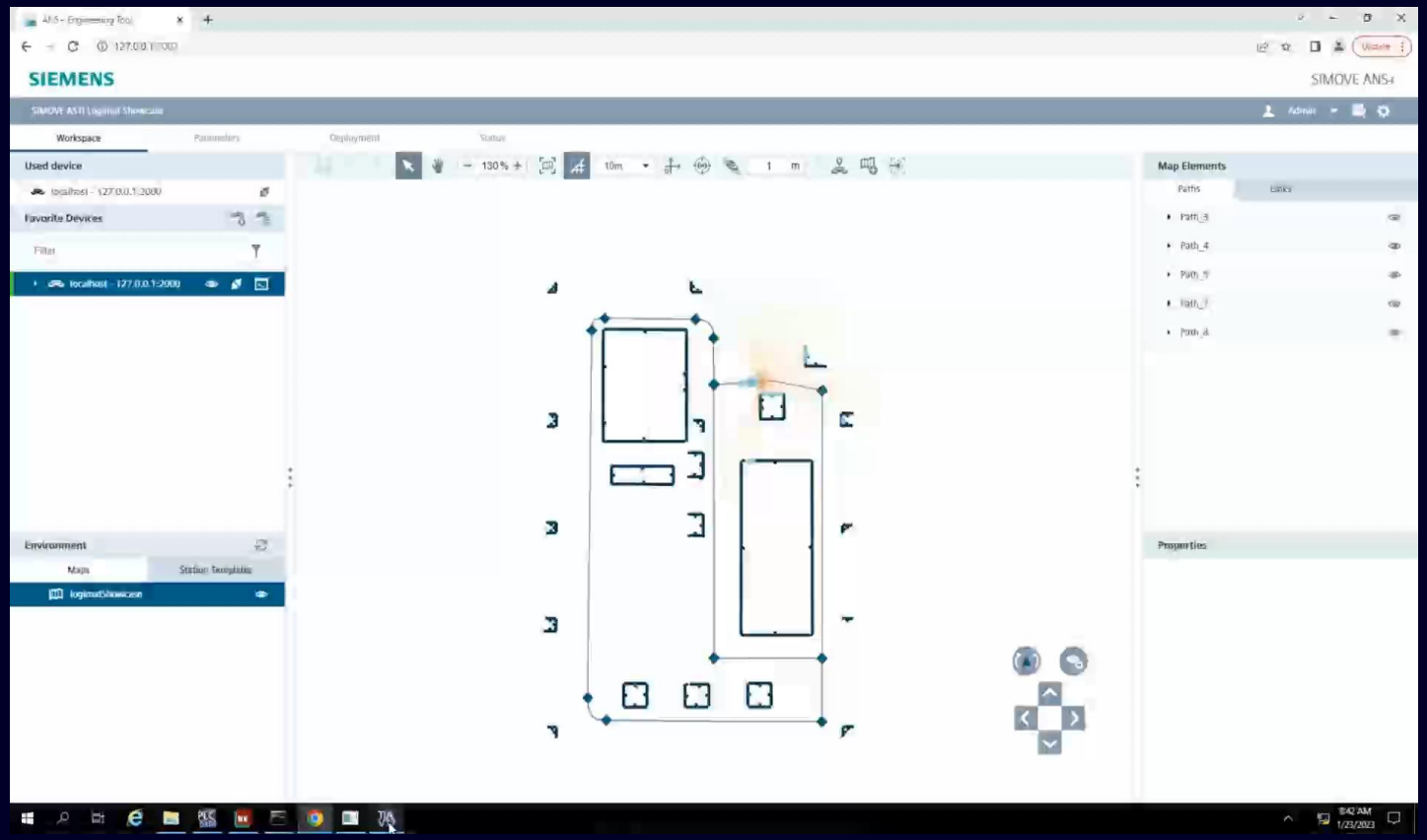
Simulation of a standalone AMR navigation and behavior
How to use virtual commissioning to optimize an AMR



Technical Solution

The PLC code controlling an individual AGV is engineered using TIA Portal and simulated with SIMATIC S7-PLCSIM Advanced.

The movement and interaction of the AMR with its surroundings is built as Digital Twin in NX MCD.

This is the basis for virtual sensor data to the SIMOVE ANS+ software. The free-moving AMR can be located and navigated.

The sensor fields are visualized inside NX MCD and the behavior of the AMR, e.g., for preventing collisions based on the sensor data, is validated in the virtual setup.

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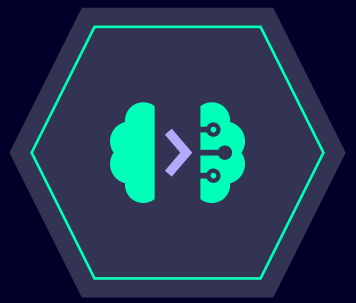
Simulation of a standalone AMR navigation and behavior
Benefits and Values

Eliminate the need of hard-ware for functional testing

… by using a software-in-the-loop setup for virtual commissioning.



Minimize physical prototypes

… by using simulation for early and thorough evaluation of machine concepts and full functional validation before starting the actual commissioning.

Greatly reduced risks of harm or damages

… by using simulation as a risk-free environment instead of testing with physical vehicles.

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Optimize material flow, layout and quantity of AMRs
How to ensure system flexibility through virtual commissioning

Use Case scenario within lifecycle

- End customer is planning a new facility with AMRs being one of the main intralogistics resources to ensure flexibility in production
- The overall system performance has high interdependencies between all (sub-)systems, e.g., system layout, fleet size and production strategies
- Multiple departments and/or (sub-)contractors are working on the implementation, e.g., AMR suppliers, system integrators, automation department etc.

Challenge

- Layout and resource decisions are often made on gut-feeling to be on the safe side potentially leading to mis-investments
- Errors often only detected on-site, especially fleet size and fleet management strategy leading to higher costs and higher time effort
- Thorough live testing of the whole fleet is very time-consuming, costly or in some cases not possible due to limited availability of resources, material etc. or access to the site
- Limited time frame during on-site commissioning leads to low repeatability and high potential risks of harm or damages

Planning and simulation

SIEMENS

Optimize material flow, layout and quantity of AMRs
With Tecnomatix Plant Simulation and
SIMATIC S7-PLCSIM Advanced

Solution

The behavior of complete plants with focus on the interaction between processing steps and AMR systems is modeled in Tecnomatix Plant Simulation.

The material flow simulation is used for the evaluation of layouts, fleet sizes and production strategies to optimize the overall system performance.

To ensure that the designed AMR system is capable of handling the requirements towards flexibility and reliability, the models is coupled with the fleet management system running in SIMATIC S7-PLCSIM Advanced.

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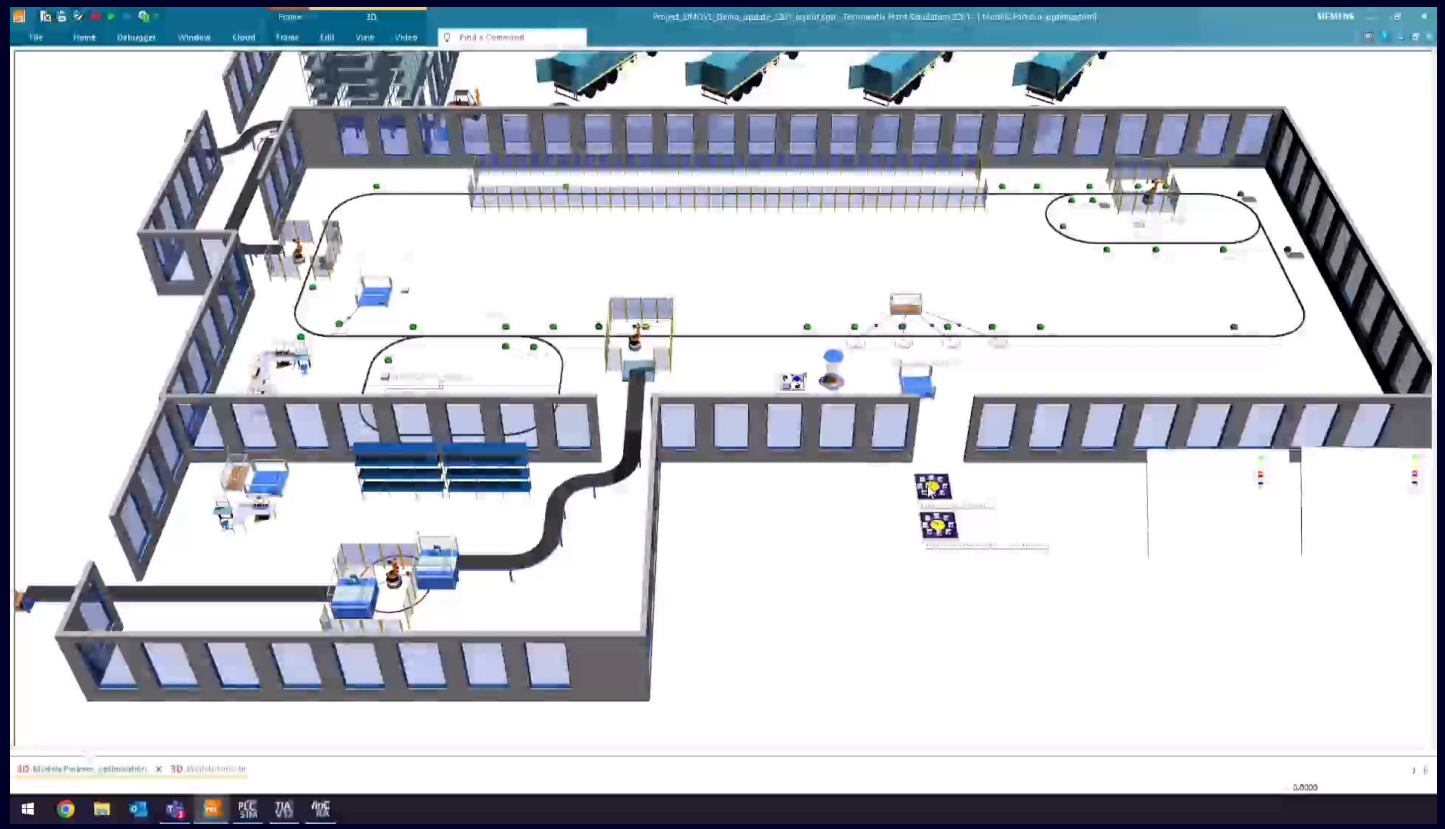
Optimize material flow, layout and quantity of AMRs
Optimization of fleet size and validation of fleet management functionality



Technical Solution

A manufacturing facility relying on AMRs for transporting the product is modeled in Tecnomatix Plant Simulation.

This model is used to study the effects of varying fleet sizes on the achievable throughput in order to find the optimal setup.

The simulation model then is connected to the PLC based fleet management system (SIMOVE Master Control or SIMOVE Fleetmanager) running in SIMATIC S7-PLCSIM Advanced.

The HMI is used to interact with the simulated AMR system and evaluate its functionalities: releasing AMRs into the robotic cell and avoiding collisions if tracks are merging or AMRs are stopped.

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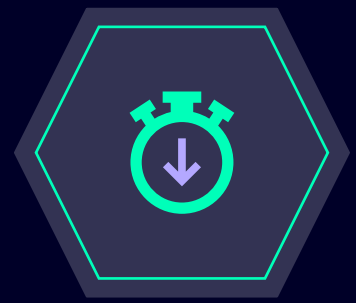
Optimize material flow, layout and quantity of AMRs
Benefits and Values

Informed investment decisions

… by using simulation for evaluation and optimization of the right AMR fleet size, loading areas and strategies with repeatable and reliable results.

Easy identification and resolving of logic issues

… through virtual integration of the fleet management system with the plant processes and completely simulated AMR fleet.



Reduced ramp-up times

… by using the simulation for virtual integration of AMR systems with higher controls systems before an AMR is even on-site.

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Validate AMR interactions with production machines
How to ensure functional AMR integration through virtual commissioning

Use Case scenario within lifecycle

- Line Builder is responsible for the delivery of a complex system involving multiple robots, handling equipment, fixtures etc. including AMRs and possibly multiple subcontractors for automation and robotics
- Automation and robotics only meet on-site to commission the system:
  Robot program finalized on-site using robot vendor specific software/hardware and combining it with PLC logic, AMRs are commissioned on-site
- Robots are directly interacting with AMRs may even include robotics for material handling

Challenge

- Risks of damages, physical harm or limitations of testing when commissioning on-site, especially in regard to safety functionalities and collisions
- By integrating AMRs, robotics/PLCs only on-site there is no evaluation of the complete sequence in advance
- Difficult to predict AMR functionality in a complex environment with high dependencies between AMR controls, robotic handling and cell automation
- AMR geometry and positioning may limit robot paths and reach requiring different fixtures

Planning and simulation

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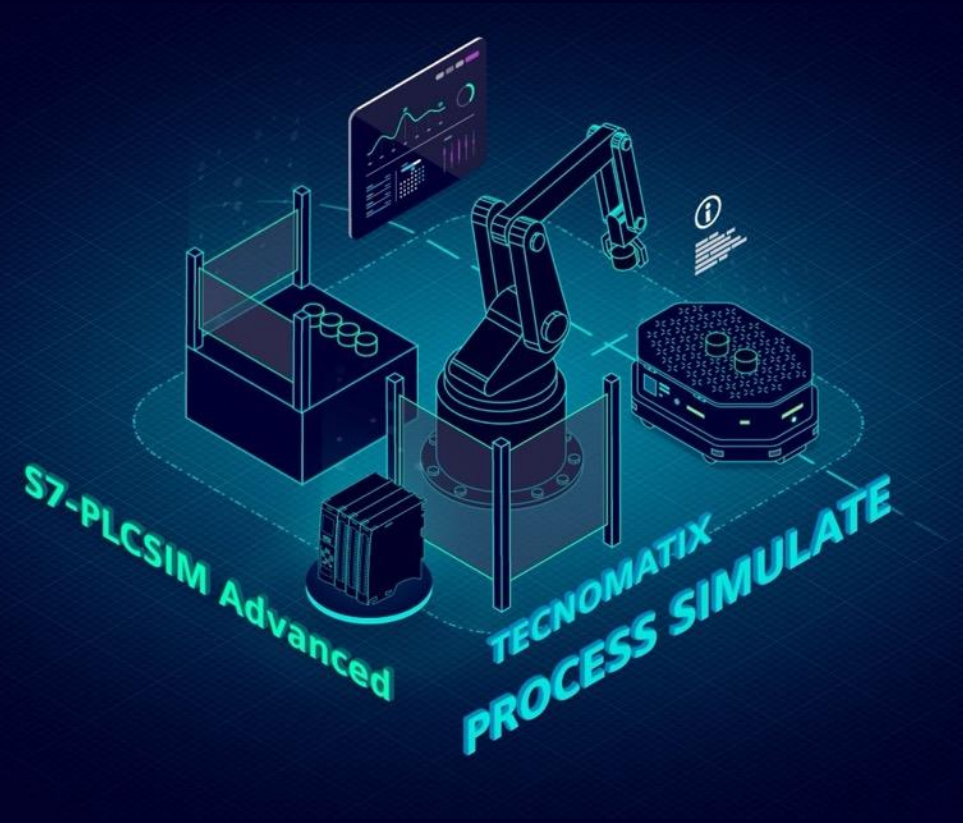
Validate AMR interactions with production machines

With Tecnomatix Plant Simulation and
SIMATIC S7-PLCSIM Advanced



Solution

For a production cell to function properly, the interaction of the individual components must run smoothly. This includes interaction between robots and AGVs, where the exact paths and timing play an important role.

Tecnomatix Process Simulate is used to design and validate complete manufacturing cells and systems taking AGV behavior into consideration.

Combining the simulation model with the real PLC code running in SIMATIC S7-PLCSIM Advanced the behavior of the system can be analyzed and optimized in depth by running various scenarios. Potentially harmful situations can be simulated and validated upfront avoiding risks during on-site commissioning.

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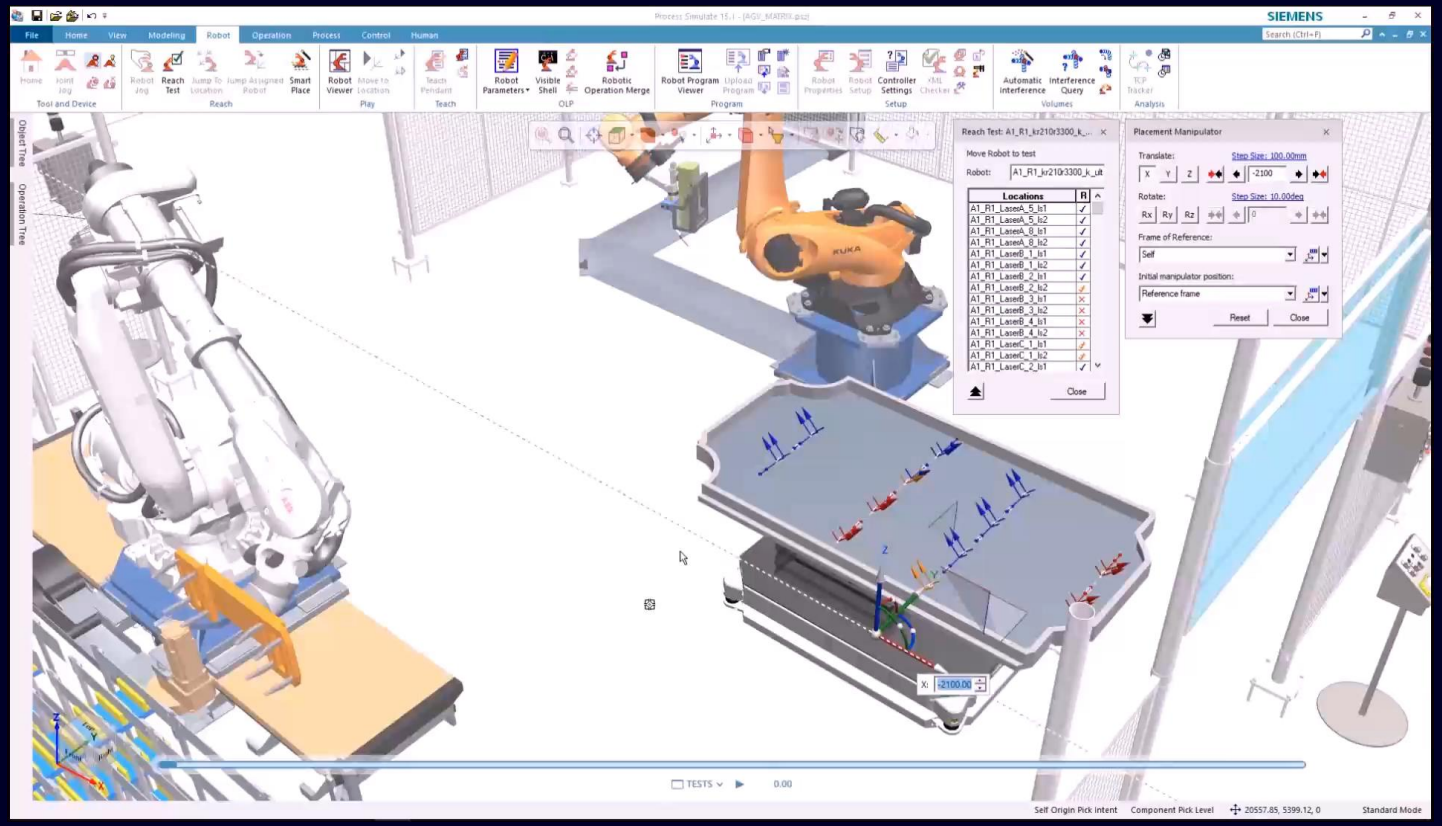
Validate AMR interactions with production machines

AMR position, fixture placement and robot actions are validated and simulated alongside PLC



Technical Solution

The target position of an AMR entering a robotic cell is defined with Tecnomatix Process Simulate. A fixture is added based on this position and a collision with the AMR is detected.

This issue is quickly resolved in the virtual environment and the reach of the robots is checked.

The whole production sequence inside the cell is validated by adding a simulated controller running in SIMATIC S7-PLCSIM Advanced.

Tecnomatix Process Simulate furthermore is also used to evaluate the behavior of the AMR controls when detecting an obstacle.

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Validate AMR interactions with production machines
Benefits and Values

Prevent collision and equipment damage

… by using simulation as a risk-free environment to test and quickly resolve otherwise costly scenarios.

Easy identification and resolving of logic issues

… by using simulation for in-depth evaluation of functionality and optimization upfront.

Ensure robot reachability at AMR target positions

… by performing full function tests of cell, robotics and AMRs before cell exists.

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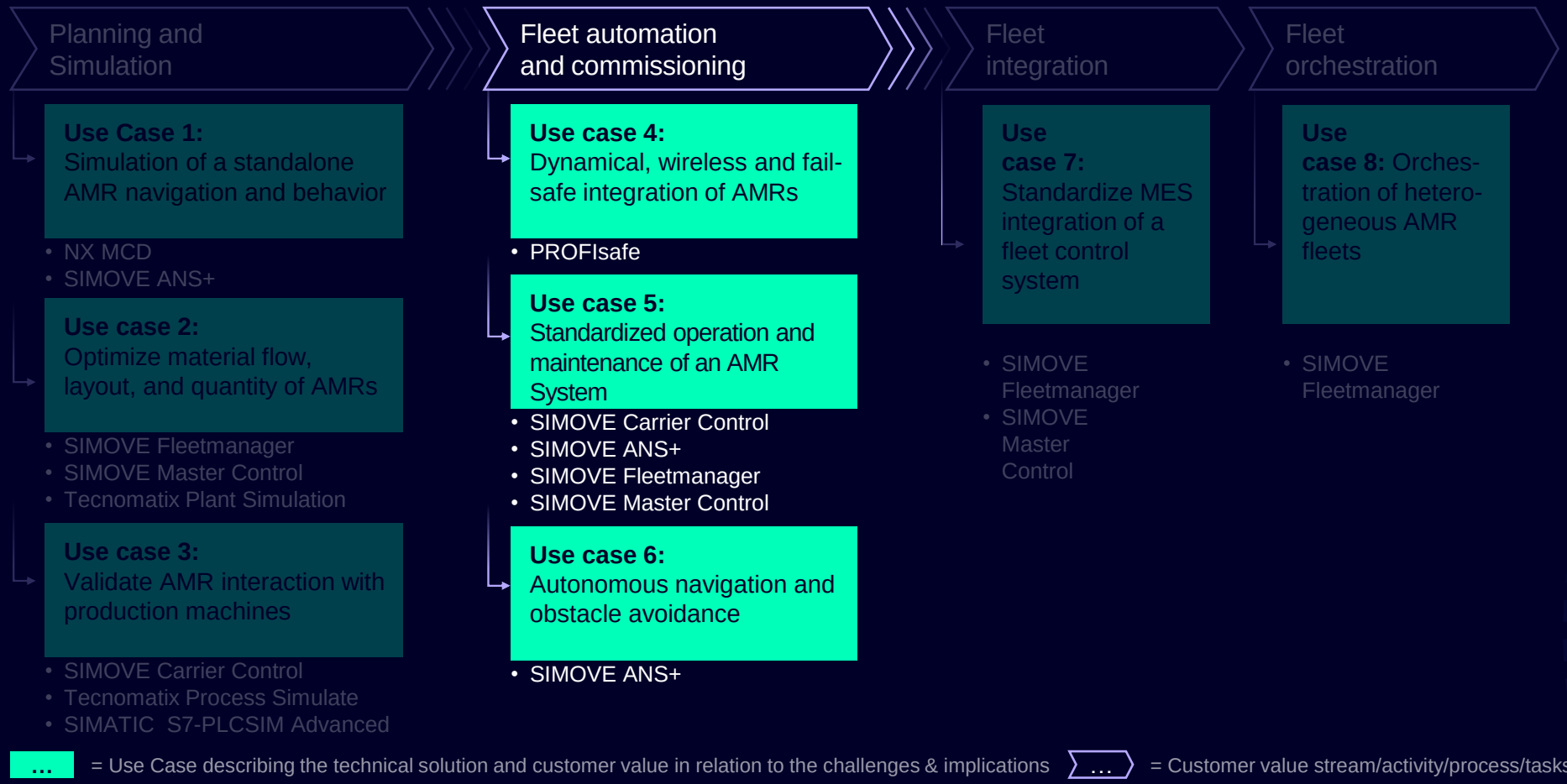
Solution Map

Use-Case and Portfolio Overview



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- Simulation of standalone AMR navigation and behavior
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- Validate AMR interaction with production machines
- Wireless and fail-safe integration of AMRs
- Standardized operation and maintenance of an AMR System
- Autonomous navigation and obstacle avoidance
- Standardize MES integration of a fleet manager
- Orchestration of heterogeneous AMR fleets

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Dynamical, wireless and fail-safe integration of AMRs to ensure a stable and deterministic communication

Use Case scenario within lifecycle

- Fulfilling EHS standards is crucial to the interaction of AMRs with production machines, especially when dealing with multiple material flows and in hazardous areas
- The integration of AMRs into production environment requires deterministic communication to guarantee riskfree operation in hazardous areas

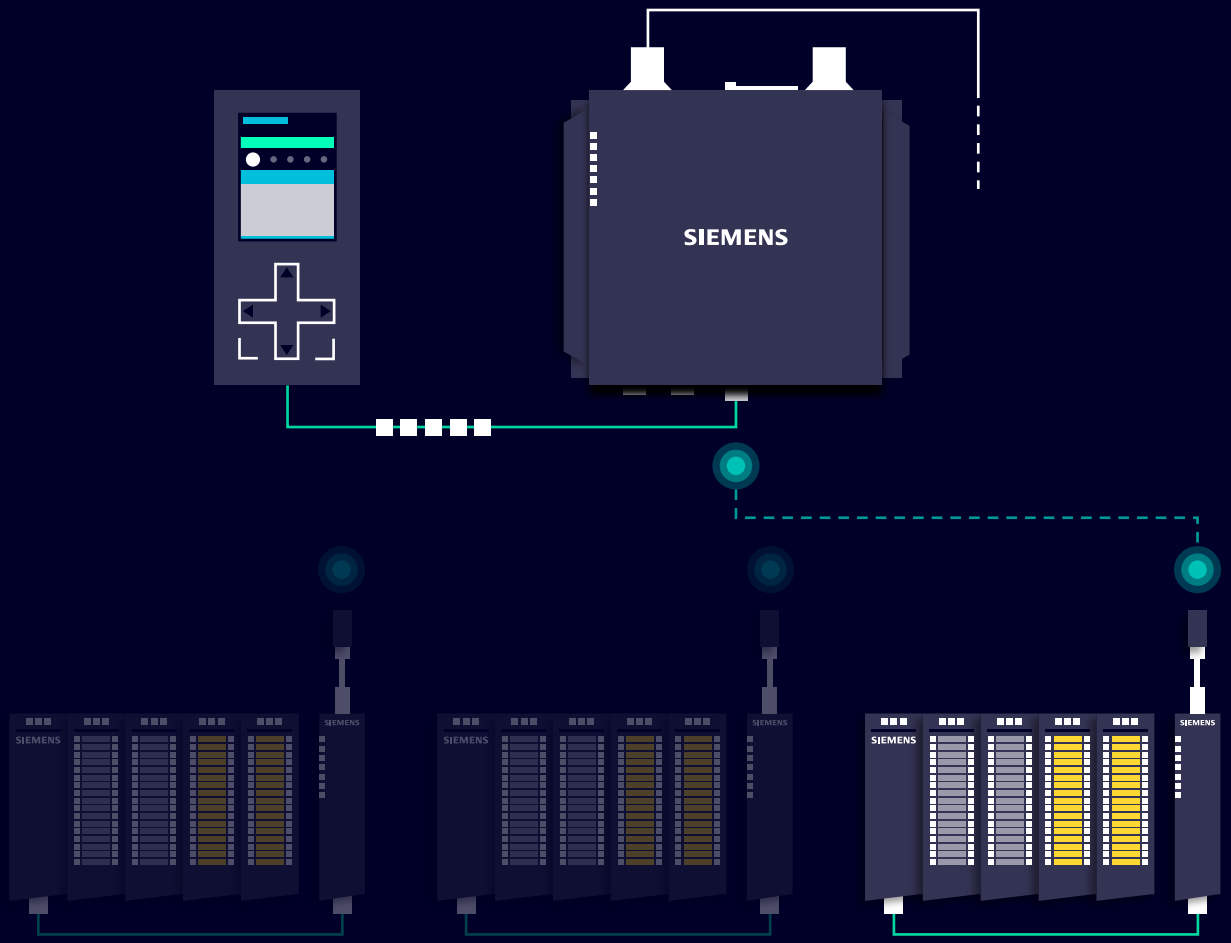
Challenge

- The non-deterministic nature of standard wireless LAN can make it impracticable to achieve safety norms compliance
- Multiple and dynamic material flows can be challenging to create a failsafe environment, also because safety norms have to be considered
- Thus makes the interaction of AMRs and machines complicated

Fleet Automation & commissioning

SIEMENS

Dynamical, wireless and fail-safe integration of AMRs with SCALANCE W, PROFINET, PROFIsafe



Solution

The iFeature iPCF for WLAN enables a stable and deterministic PROFINET and PROFIsafe communication. It's integrated in the Siemens Industrial Wireless LAN SCALANCE W components and ensures a prioritized data traffic.

SCALANCE W

Enables a reliable real-time wireless communication and data transfer on the shop floor.

PROFINET

Provides real-time communication, data exchange and seamless integration between various automation devices

PROFIsafe

Guarantees the exchange of fail-safe signals and safety relevant data in the automation environment.

SIEMENS

Dynamical, wireless and fail-safe integration of AMRs to ensure a stable and deterministic communication

Technical Solution

IWLAN iFeature (iPCF): the industrial feature in the IWLAN devices provides deterministics and fast roaming, which are required for uninterrupted data exchange that is needed for wireless PROFINET and PROFIsafe communications.

The I-Device feature allows a CPU-CPU communication via PROFINET and PROFIsafe and sends/receives the data directly in the I/O-process image of the respective PLC.

The dynamical safety address changes (DP/DP-ID) during operation enable flexibility in connecting to different F-PLCs.

The failsafe data is exchanged as failsafe arrays between the F-CPUs via standard communication mechanisms (possible via other communication e.g., private 5G).

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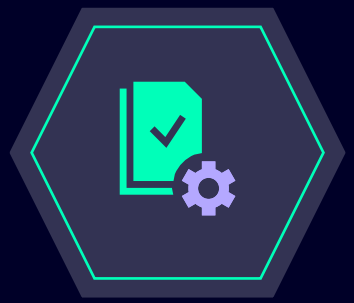
Dynamical, wireless and fail-safe integration of AMRs
Benefits and Values

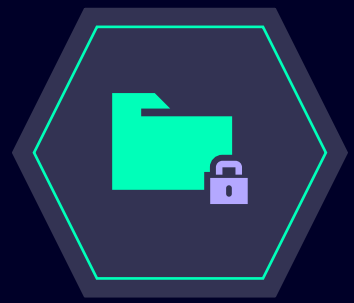
Deterministic communication

… by offering a reliable and deterministic wireless communication between AMRs and production machines.
The flexibility of AMRs increases while the risk of errors in the material flows will be reduced.



Meeting safety norms

… by minimizing risks of accidents in the production environment due to reliable transfer of safety-critical data minimizes risks.



Efficient and secure production processes

… by enabling a secure navigation of AMRs in the shop floor while meeting safety norms and standards.
Simplifying the integration of AMRs, reduces complexity and effort.

SIEMENS

Standardized operation and maintenance of an AMR System
How to enable an efficient engineering of an AMR

Use Case scenario within lifecycle

- The continuously evolving customer requirements and require a flexible and individual production
- This leads to a higher need of flexibility in the production processes, too. Especially the use of the AMRs need to be considered

Challenge

- Companies use various AMRs for different tasks from different manufacturers. The efforts of the plant operator rises with each new AMR
- Maintaining and operation know-how has to be trained
- Increasing integration efforts especially in one common environment

Fleet Automation & commissioning

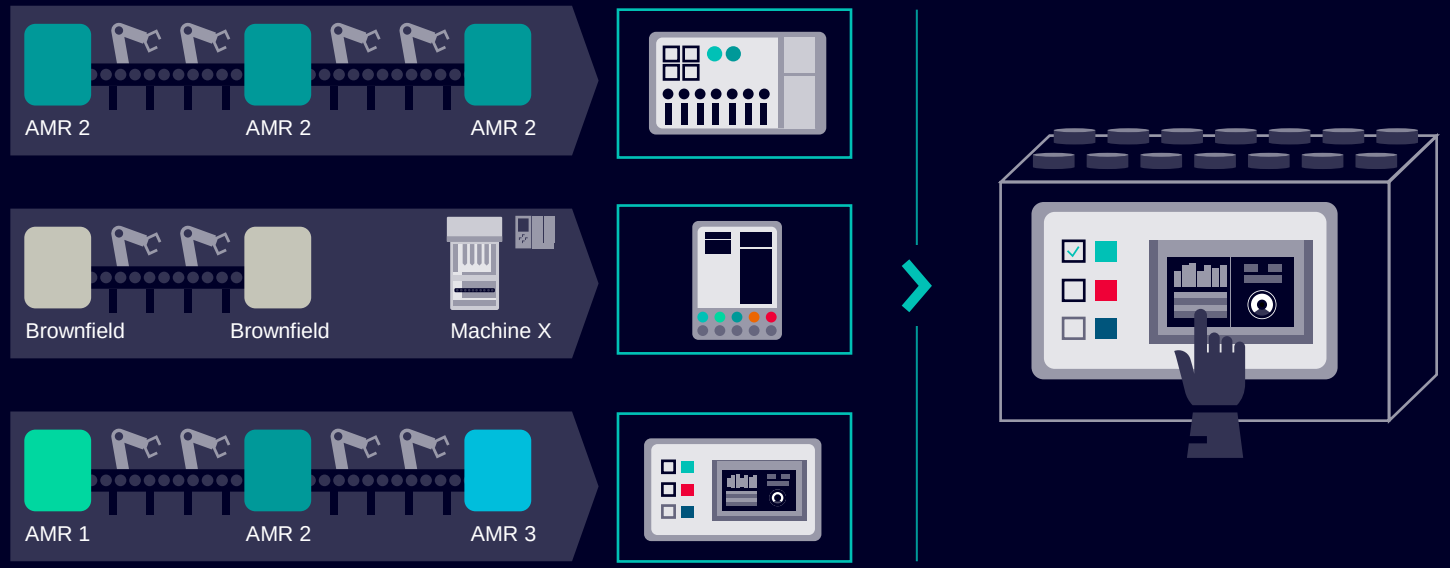
TOPIC 1 | Dynamical, wireless and fail-safe integration of AMRs

TOPIC 2 | Standardized operation and maintenance of an AMR System

TOPIC 3 | Autonomous navigation and obstacle avoidance

SIEMENS

Standardized operation and maintenance of an AMR System – With SIMOVE Carrier Control, SIMOVE ANS+ and SIMOVE Master Control



Solution

SIMOVE Carrier control
Includes the use of standard automation and drive components as well as customized software tools and libraries.

SIMOVE ANS+
Laser based navigation integrated in the common hardware platform and includes a sophisticated route and map management
Besides that, it is integrated in SIMOVE Carrier control.

SIMOVE Master Control
Maintenance and diagnostic via various functions, which help to analyse parameters quickly, such as route information, location of AMRs, batter status and system alarms.

SIEMENS

Standardized operation and maintenance of an AMR System – To reduce efforts and ensure interoperability

Technical Solution

SIMOVE is based on standardized, vendor independent software modules for all types of AMRs.

Usage of standard, globally available automation hardware.

Free of charge software and TIA Portal library with sample project and a predefined engineering framework with openness to realize use-case specific extensions.

A continuous standardized look & feel enables the plant operator to take care of operation, maintenance and diagnostics through basic SIEMENS automation know-how.

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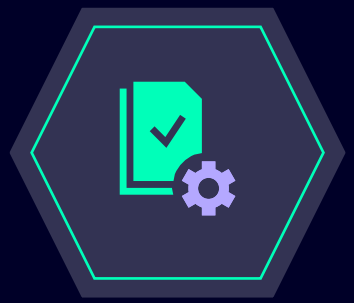
Standardized operation and maintenance of an AMR System
Benefits and Values

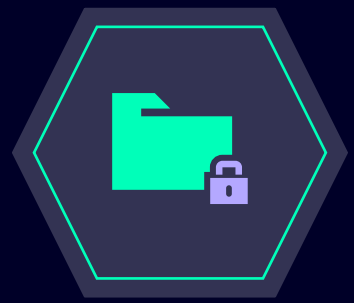
Ensuring Interoperability

… by seamless work processes between different AMRs in the same environment.



Reducing integration efforts

… by consistent layout regarding operation, diagnosis and maintenance.



Standardized spare part system

… by reducing inventory management and storage costs , all that AMR manufacturer independent.

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Autonomous navigation and obstacle avoidance
How to define navigation routes as flexible as possible

Use Case scenario within lifecycle

- The management of material flow has to be flexible enough to be quickly adapted to fast changing consumer preferences
- As soon as a production gets flexible, paths in the shop floor are not only used by AMRs, but also from manual forklifts and other assets

Challenge

- AMRs have to consider obstacles in their paths which might limit their flexibility
- Transport of material will last longer, which might lead to less efficiency
- Safety aspects has to be considered

Fleet Automation & commissioning

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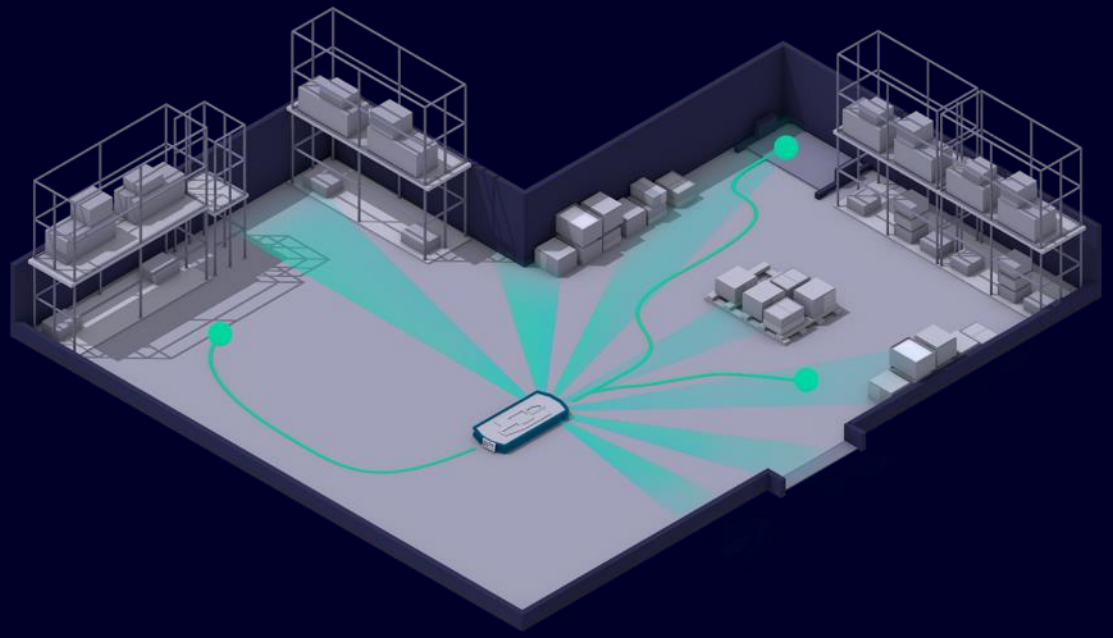
Autonomous navigation and obstacle avoidance
With SIMOVE ANS+



Solution

SIMOVE ANS+

The laser-based navigation system enables a dynamical route planning of the AMRs, while considering all environmental situations.

SIMOVE ANS+ allows manufacturers to restrict the flexibility of the AMRs to specific areas, while considering the traffic rules on the shop floor.

This is how flexibility of the AMRs can be defined on an individual level, always considering the path conditions in the production environment.

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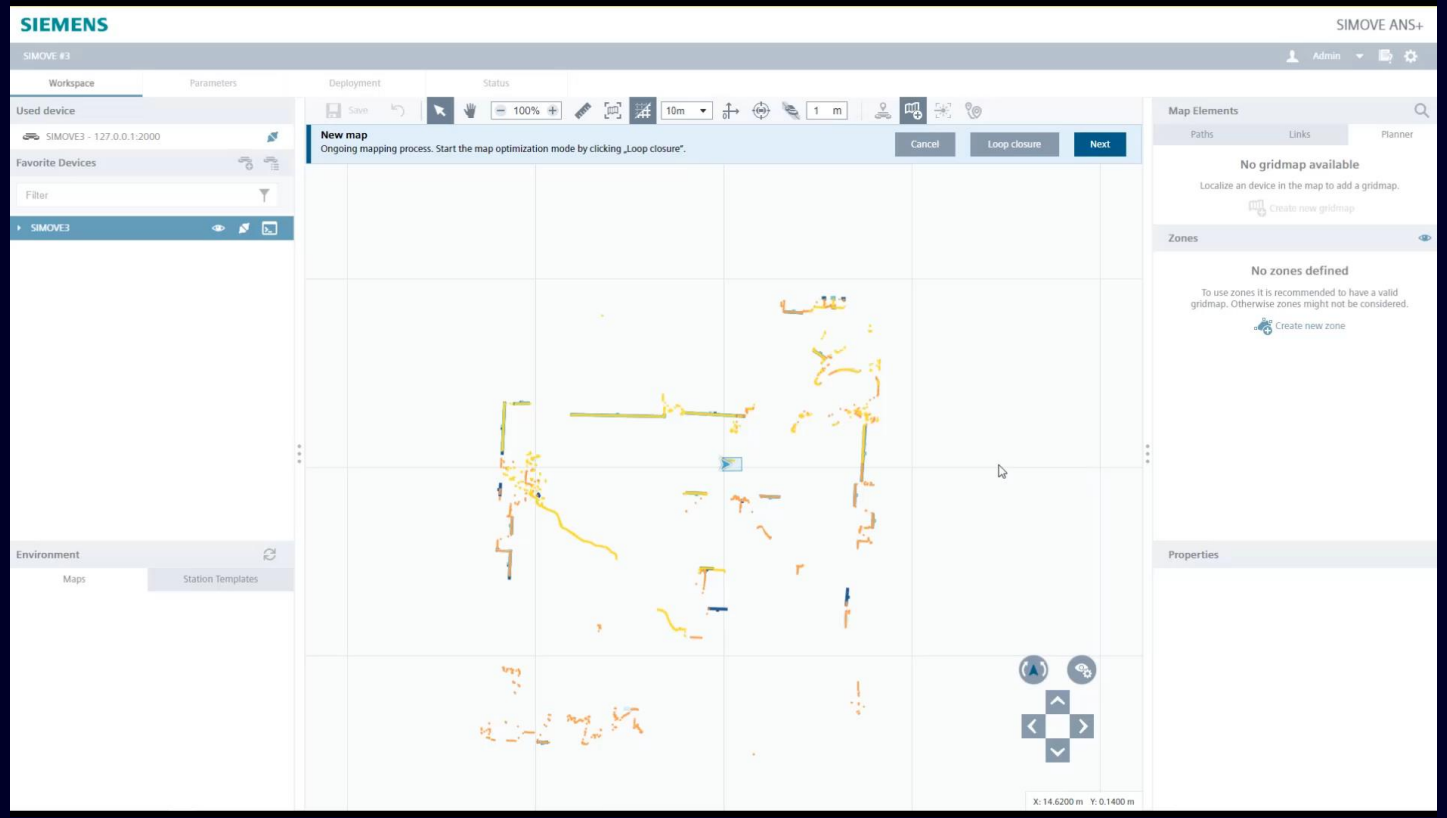
Autonomous navigation and obstacle avoidance
To create flexible navigation routes for AMRs



Technical Solution

Use of SIMOVE ANS+ for flexible material handling based on virtual tracks.

Generate a virtual map of the entire production environment including virtual tracks as well as loading and unloading stations.

Based on production needs, AGVs are able to move between all loading and unloading stations in a flexible way.

In case of obstacles on the path, SIMOVE ANS+ offers to bypass these objects automatically.

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Autonomous navigation and obstacle avoidance
Benefits and Values

Less planning effort

… by a laser-based navigation software package that can simply be used in existing building and production infrastructure supporting every type of AMR even of different manufacturers.

Higher production flexibility

… by flexible material and production handling based on dynamic path planning with obstacles being bypassed automatically.

No change in infrastructure necessary

… by generating virtual maps of the entire production area using existing landmarks without the need to add additional markers or features.

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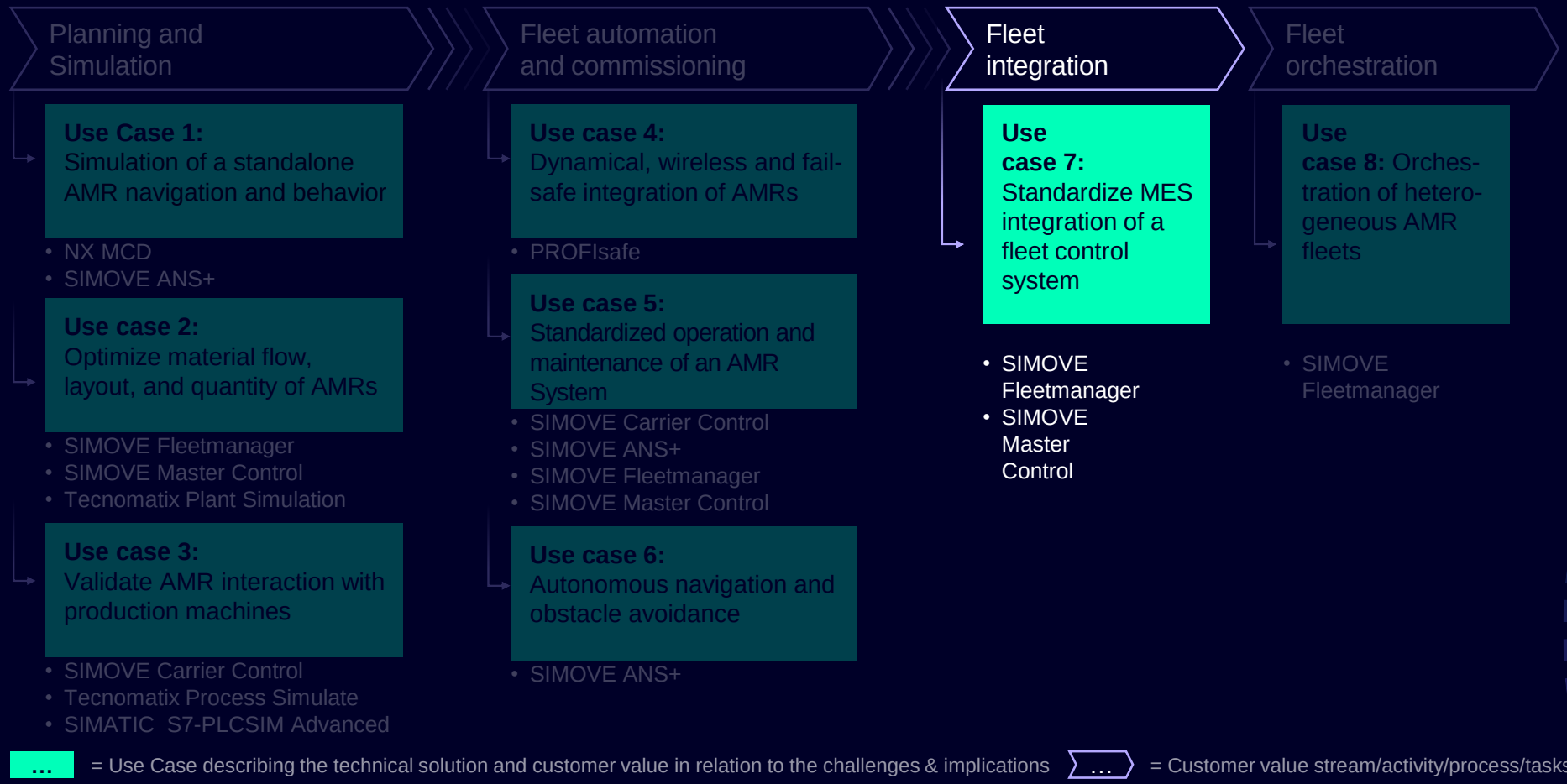
Solution Map

Use-Case and Portfolio Overview



Simulation of standalone AMR navigation and behavior

Optimize material flow, layout, and quantity of AMRs

Validate AMR interaction with production machines

Wireless and fail-safe integration of AMRs

Standardized operation and maintenance of an AMR System

Autonomous navigation and obstacle avoidance

Standardize MES integration of a fleet manager

Orchestration of heterogeneous AMR fleets

… = Use Case describing the technical solution and customer value in relation to the challenges & implications … = Customer value stream/activity/process/tasks

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Standardize MES integration of a fleet control system
How to ensure an efficient workflow management

Use Case scenario within lifecycle

- The increasing demand of individualization of customer preferences has a direct impact of industries to adapt their production quickly
- Increased material flow and complex logistic routes are the consequence

Challenge

- Often there is no defined standard interface to connect an AMR fleet management system to other IT systems e.g., from customers
- Significant effort for implementation and maintenance of interface

Fleet orchestration

TOPIC 1 | Standardize MES integration of a fleet control system

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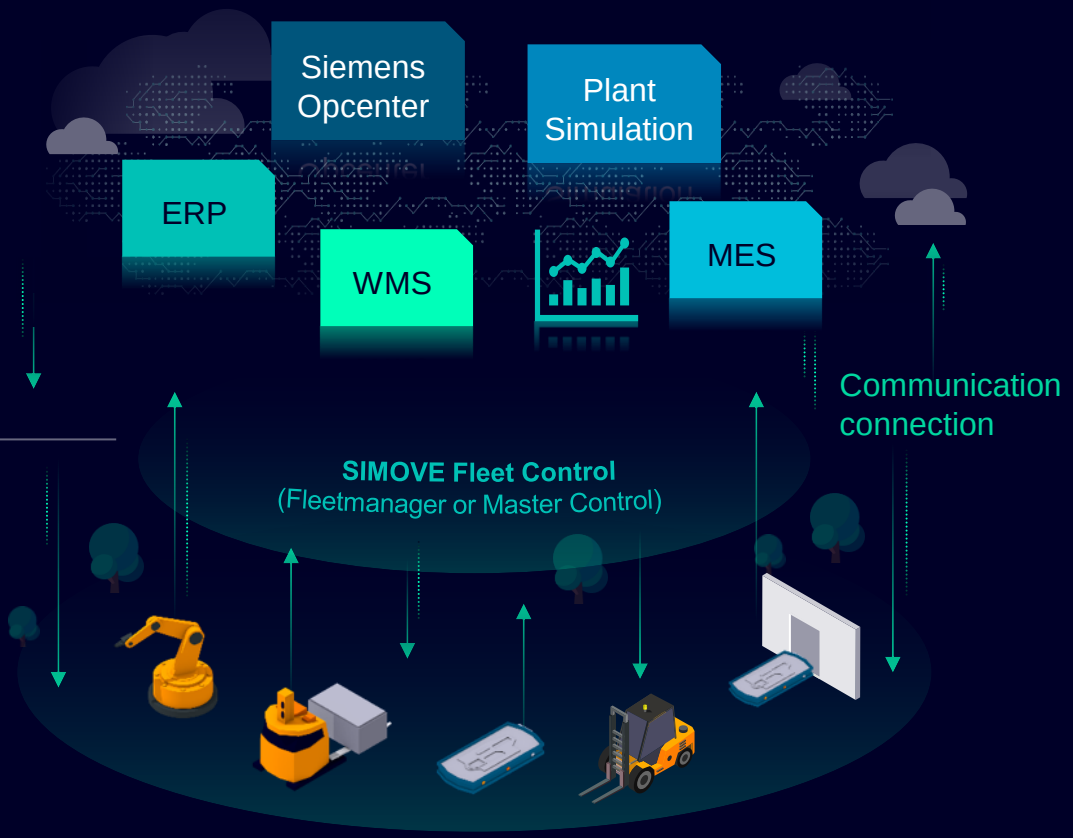
Standardize MES integration of a fleet manager
with SIMOVE Fleetmanager and SIMOVE Master Control



Solution

SIMOVE Fleetmanager
Standardized, reliable, and efficient interoperability with shop floor devices is a crucial part for efficient manufacturing processes. Implementation of this integration between the MES level and the shop floor means a huge effort. Especially tag and protocol definition, development of dedicated business logic, and integration tests are time consuming.
The SIMOVE Fleetmanager reduces this efforts by providing a standardized Transport Order Management API.

SIMOVE Master Control
Maintenance and diagnostic via various functions, which help to analyze parameters quickly, such as route information, location of AMRs, battery status and system alarms.

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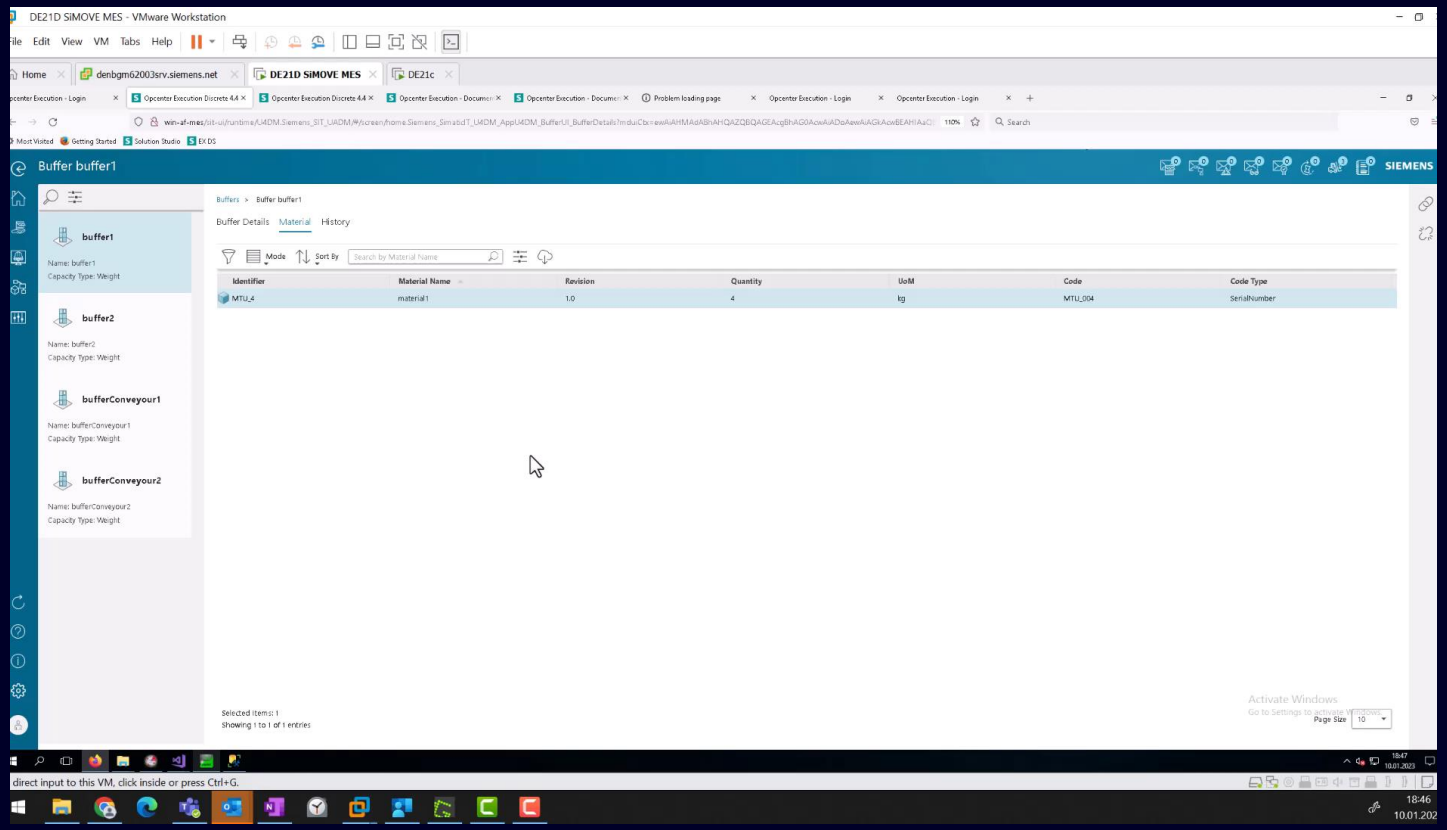
Standardize MES integration of a fleet manager
for standardized interfaces to the fleet management system



Technical Solution

SIMOVE Fleetmanager provides a REST based interface named “Transport Order Management (TOM) Sync API” for creating, updating, cancelling and retrieving status of transport orders (i.e., trips).

SIMOVE Master Control has an application example for connecting to MES system (Opcenter) with an interface via OPC UA.

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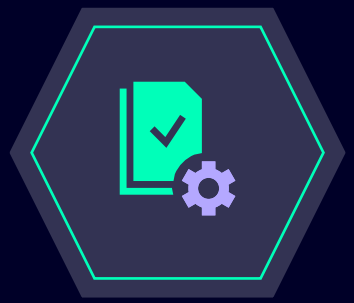
Standardize MES integration of a fleet manager
Benefits and Values

Standardized interfaces

… by connecting the fleet management system to other IT systems.
This allows the orchestration of orders in a standardized way.



Secure communication

… by using TLS for the communication concept.

Future-proof

… by enabling the control also of manual guided vehicles such as forklifts.

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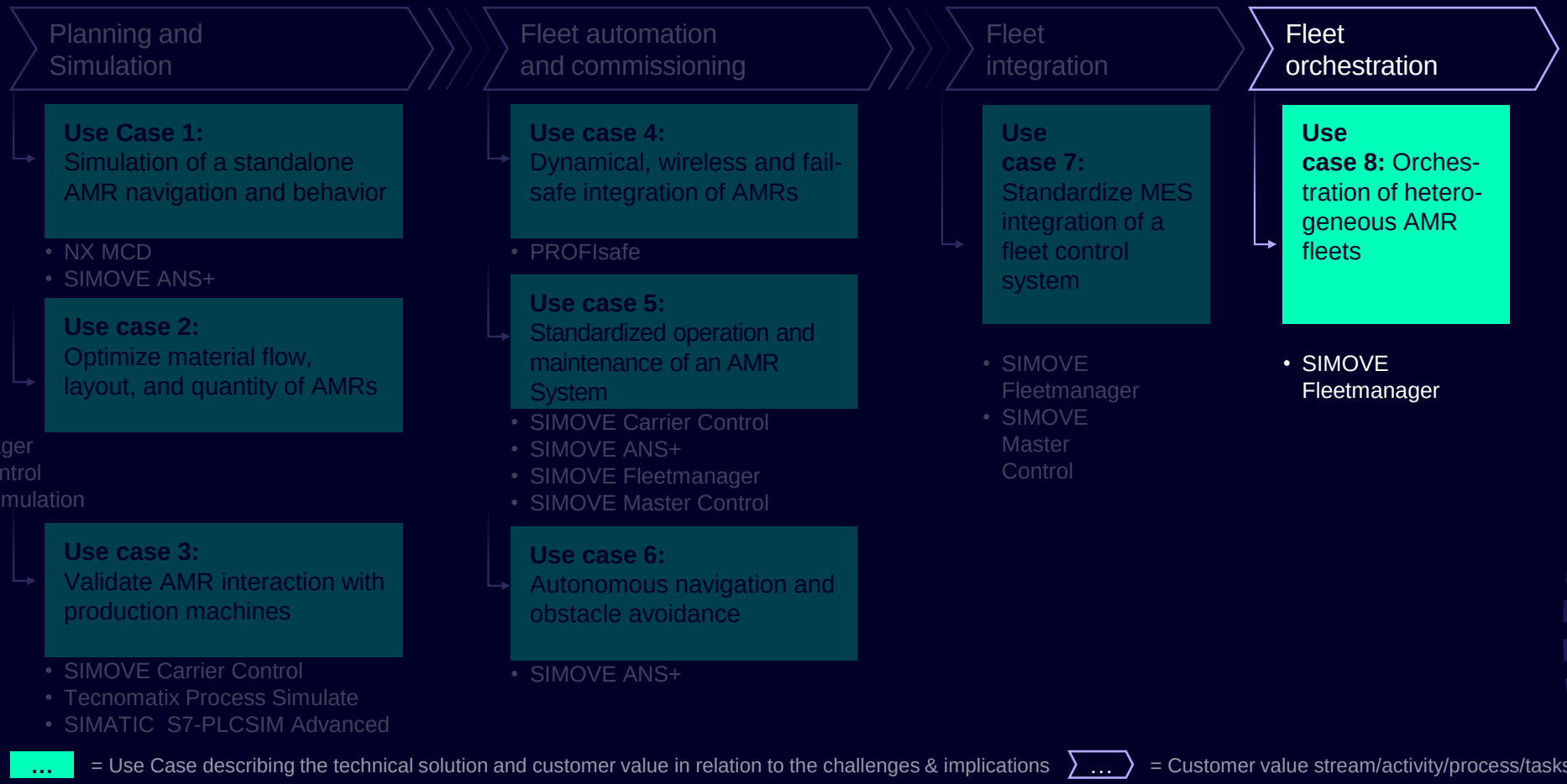
Solution Map

Use-Case and Portfolio Overview



- Simulation of standalone AMR navigation and behavior
- Optimize material flow, layout, and quantity of AMRs
- Validate AMR interaction with production machines
- Wireless and fail-safe integration of AMRs
- Standardized operation and maintenance of an AMR System
- Autonomous navigation and obstacle avoidance
- Standardize MES integration of a fleet manager
- Orchestration of heterogeneous AMR fleets

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Orchestration of heterogeneous AMR fleets
How to integrate AMRs in one standardized system

Use Case scenario within lifecycle

- The step-by-step modernization of companies often leads to heterogeneous AMR fleets from different manufacturers
- The heterogeneity creates a broad system landscape

Challenge

- The orchestration of AMR fleets from different manufacturers is time consuming
- Orders have to be executed as efficient as possible
- The fleet orchestration needs to be able to take all states of the system into account
- Changes in the system and the layout are time consuming and require work from the AMR manufacturer

Fleet orchestration

TOPIC 1 | Orchestration of heterogeneous AMR fleets

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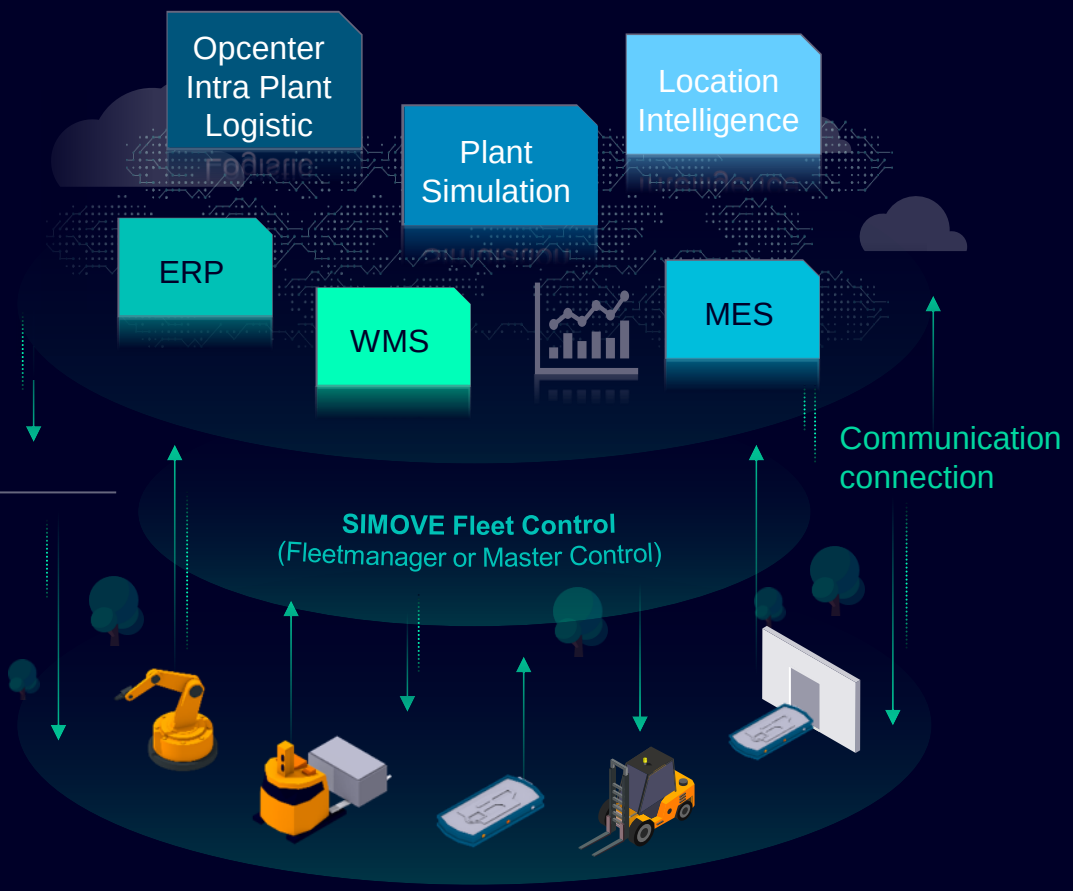
Orchestration of heterogeneous AMR fleets
With SIMOVE Fleetmanager



IT

IT/OT
connectivity

OT

Solution

SIMOVE Fleetmanager

Non-vendor specific and standardized interface to control of AMRs.

It is also possible to integrate manually controlled vehicles into the system.

Algorithms optimize routing reduce congestions and maximize the workload of the AMR fleet.

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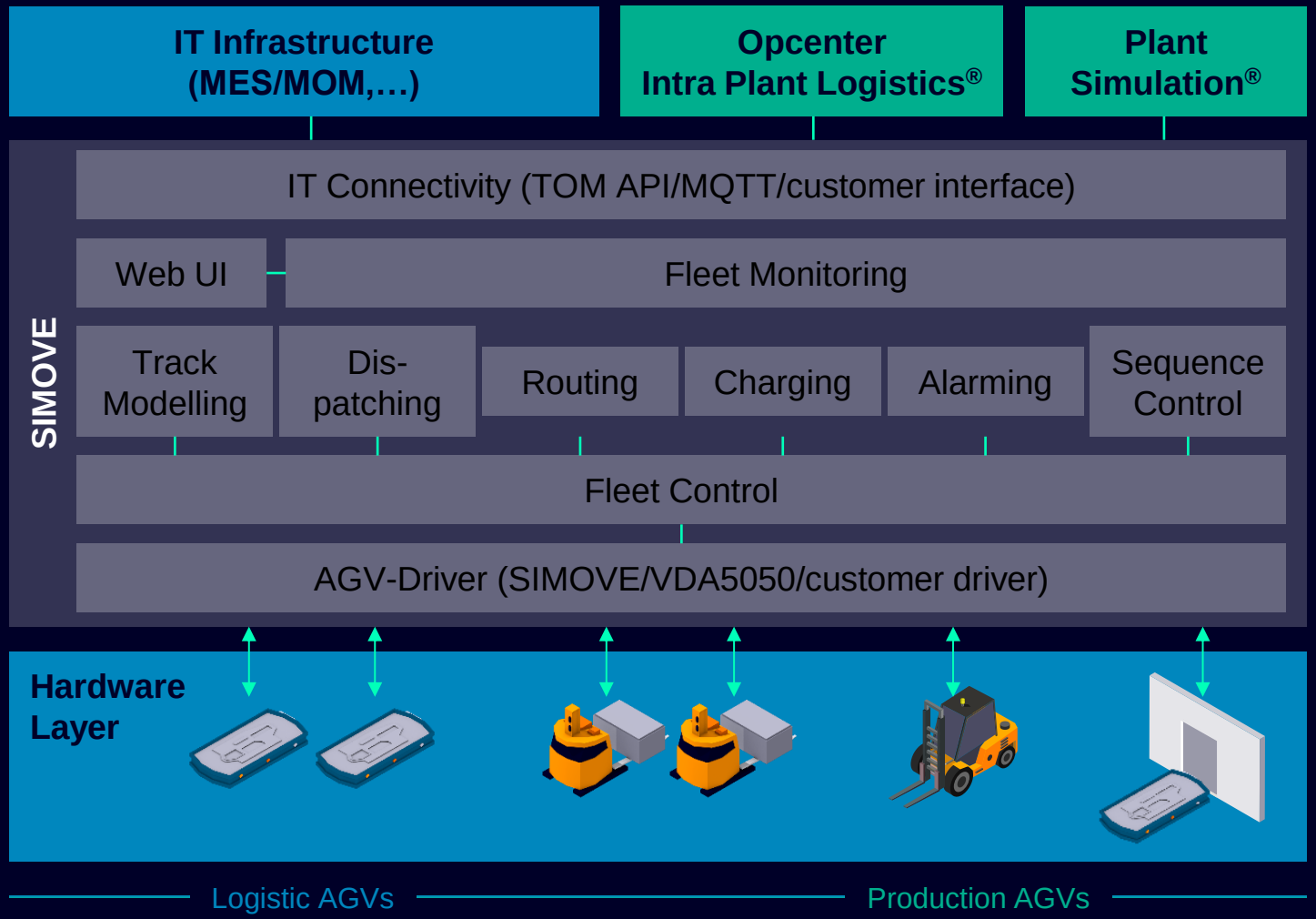
SIMOVE Fleet Manager
Uniform fleet management system



One fleet management …

- to Connect AGVs & AMRs from different suppliers
- To orchestrate different types of AGVs & AMRs
- To interface northbound systems and other host systems (REST API, TCP/IP, OPC UA, MQTT, Kafka, Plant Simulation …)
- To interface southbound systems (SIMOVE, VDA 5050, MQTT, S7/S7+, OPC UA…)
- To standardize fleet diagnostics

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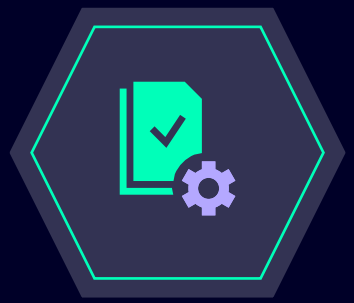
Orchestration of heterogeneous AMR fleets
Benefits and Values

Master material flow complexity

… by integrating heterogeneous AMR fleets in one system – The scalable and flexible software system is ready for future requirements.



Reducing operational costs

… by using algorithms for optimizing the routing, which reduce congestions, and maximize the workload of the AMR fleet.

Optimized production processes

… by orchestrate manual driven forklift together with your autonomous fleet, to optimize the whole production and logistics process.

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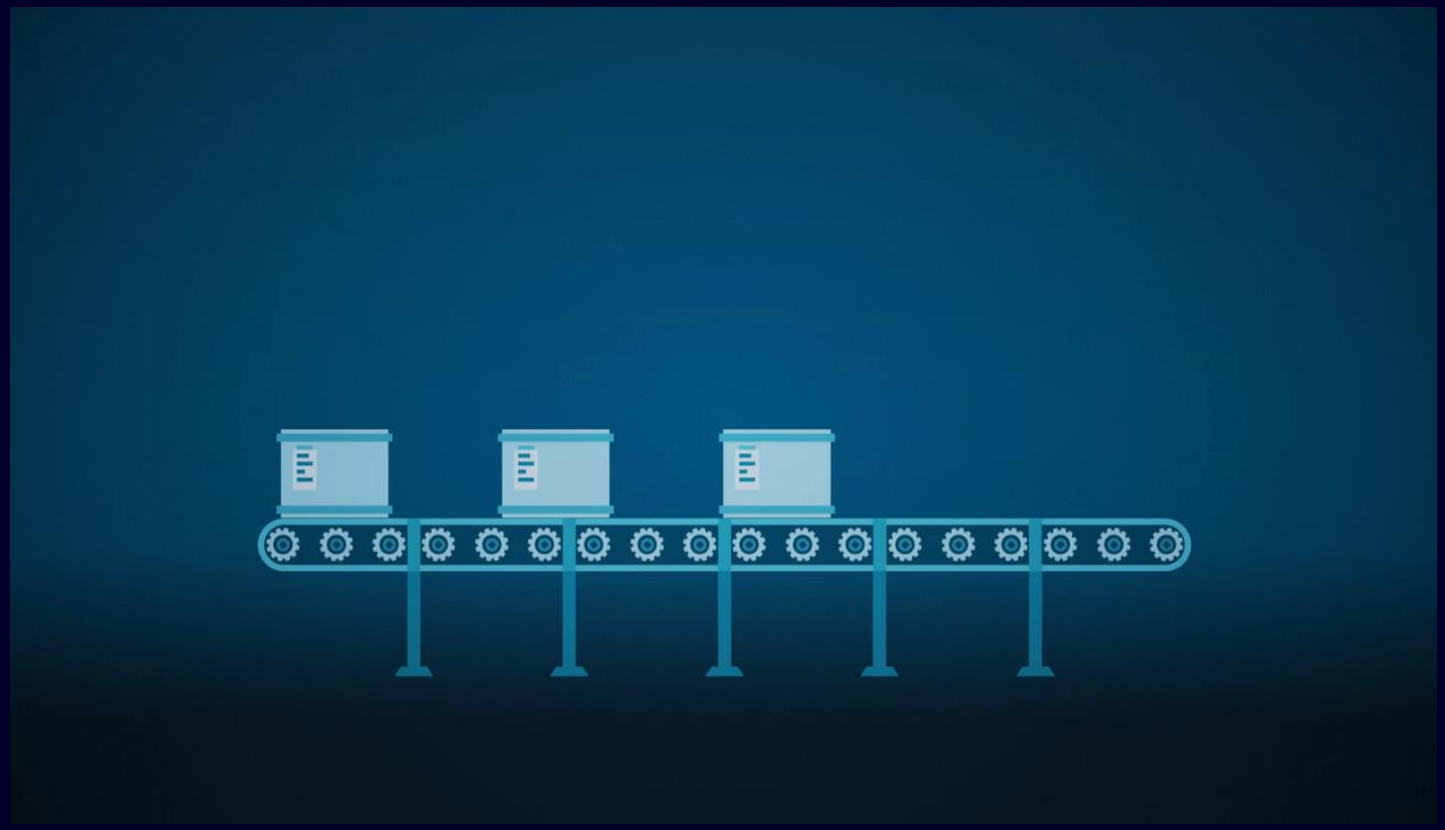
Orchestration of heterogeneous AMR fleets
To optimize the interaction different AMR fleets



Technical Solution

Today, there are many different Automated Guided Vehicles and Autonomous Mobile Robots manufacturers offering vehicles and technology to the market. Typically, these AGVs and AMRs do only work with their own specific fleet management software.

As soon as you wish to have mobile robots from more than one supplier … you will face some complex challenges. The SIMOVE Fleetmanager provides interoperability by using the VDA5050 interface.

Using only one Fleet management system, which uses algorithms to optimize routing reduces congestions and maximize the workload of the whole fleet.

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SIMOVE Fleetmanager
Integrated vendors

Integrated
- Omron
- Safelog
- Bosch Rexroth
- MLR
- DS Automation
- Still
- EK Robotics
- Grenzebach
- Knapp
- Stäubli
- AGILOX
- Tünkers
- AGVR
- Artisteril
- Bär
- Kivnon
- Synersight
- ABB-Asti
- Smarlogy

Integrated
- Daum und Partner (DPM)
- VDL
- AV-T
- Sunyell
- KS Control
- Gebroeder Doms
- HikRobots
- EBZ
- FFT
- Selettra
- Inogec

Onboarding ongoing
- Lista/Gouzi
- Jungheinrich
- MIR
- Eisenmann

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All family members and friends of SIMOVE AGV – holistic solution approach

Component overview

SIMOVE **AGV**

MES / **Intra Plant Logistics**

IPL

Location Intelligence (**RTLS**)

SIMOVE **Fleetmanager**

FM **LI** **PS**

Plant **Simulation**

SIMOVE **APP**

APP **CC** **ANS+** **LOC**

Standard SIEMENS **Hardware Portfolio**

SIMOVE **Carrier Control**

SIMOVE **ANS+**

SIMOVE **LOC**

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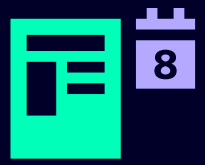
You can overcome the challenges with Siemens

Challenges

Managing dynamical material flow planning



Inconsistent and siloed Data

High complexity of interoperability of heterogeneous systems

Complying with safety standards

Value

Logistical, dynamic simulation:

- **Optimizes** system throughput and efficiency
- Is the base for **informed** investment **decisions**
- Facilitates the identification and **resolution of logic issues**

Holistic Simulation:

- **Seamless data integration** for collaboration
- Maximize efficiency with **reusable models**
- **Streamline tasks** avoiding unforeseen issues during production ramp-up

Standardized systems:

- **Reduce** engineering and commissioning **efforts**
- Decrease time-to-market
- **Minimize** operational and maintenance **costs**
- **Ensure interoperability** between machines and fleets

Safety Integrated:

- **Enables safe collaboration** between AGV and other equipment
- **Reduces effort** to meet safety standards
- **Minimizes risks** of accidents

Solution

Flexible production with AGV and AMR

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SIMOVE

References

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SIMOVE Customer Reference Video
BMW i3 Production

SIEMENS

SIMOVE Customer Reference Video
HP | The factory of the future for 3D printing

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Example: Production of the Mercedes-Benz S-Class in Factory 56

Image Source: https://group.mercedes-benz.com/innovation/digitalisierung/industrie-4-0/eroeffnung-factory-56.html

Challenges

- Most innovative production in Mercedes-Benz and blueprint for other Mercedes-Benz production sites worldwide
- High degree on plant digitalization and connectivity
- Integration of various AGVs from different suppliers

Solution

- Maximum flexibility using **100** AGVs with SIMOVE and **400** logistic AGVs in one fleet management system
- Final assembly, IVM and CVM fully automated with SIMATIC controllers and equipped with drive technology components on one platform TIA Portal

SIMOVE Fleetmanager

SIMATIC

TIA Portal

SIMOVE

SIEMENS

Example: Scania Södertälje – Battery Module Line & Pack line

Image Source: https://www.scania.com/sodertalje/sv/home.html

Challenges

- Battery assembly is highly automated from incoming goods throughout production to delivery
- High degree on plant digitalization and connectivity
- Two phases project Module line / Pack line

Solution

- SIMOVE Fleetmanager as fleet management system
- Safety concept based on AGV & conveyor onboard devices
- AMRs from Supplier Artisteril powered by SIMOVE
- Standard Interface VDA5050

SIMOVE Fleetmanager

SIMATIC

Plant Simulation SIMOVE

SIEMENS

Example: Siemens Gerätewerk Amberg– Electronics Manufacturing

Image Source: https://assets.new.siemens.com

Challenges

- Initial situation: One system for each transport type
- Integration of an existing forklift master control in SIMOVE, including new visualization for forklift terminals.
- Brownfield plant – Migration during on-going operation
- Vendor-specific interface for forklift AGVs
- Implementation of an order prioritization, instead of FIFO

Solution

- SIMOVE Fleetmanager including Forklift Terminal
- > 20 vehicles (Up to 17 forklifts, 5 AGVs)
- All transport orders in one system
- For order prioritization and allocation, all types of transport orders will be considered, which leads to an optimization of the utilization.

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SIMOVE Customer References

FFT Produktions GmbH&Co.KG, Germany, Machine building

FFT | The intelligent AGV for integrated production systems

HP, Spain, Machine building

HP | The factory of the future for 3D printing

VDL Steelweld, Netherlands, Machine building

VDL Steelweld | A flexible and safe AGV system for a dynamic outdoor environment

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SIMOVE Customer References

DMG MORI, Germany, Intralogistics

DMG MORI | Autonomous and flexible – an AGV for high loads

Porsche AG, Germany, Automotive

Porsche AG | Innovative conveyor technology solutions for the Porsche Taycan production

SIEMENS

SIMOVE Customer References

BUILDING OUTDOOR AGV WITH SIMOVE

SIMOVE takes packages from sorting to auction - **autonomously**

SIEMENS

Thank you!

SIEMENS