



Simulation as a process optimization tool in automotive intralogistics

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Mercedes-Benz
Vans. Born to run.



Executive summary

Mercedes-Benz Vans logistics engineers needed a tool to assess and optimize the efficiency in context of wide AGV implementation in plant intralogistics.

Following efficiency aspects were in focus:

- 🎯 Amount of equipment used
- 🎯 Pooling of workforce for irregular tasks
- 🎯 Non-productive time (traffic, wait, repack)
- 🎯 Travelling distance
- 🎯 No assembly line shortages
- 🎯 Stock re-order levels
- 🎯 Delivery tours utilization (containers per tour)

Challenges in automotive intralogistics



Long list of components

Tens of thousands part numbers assembled in same plant



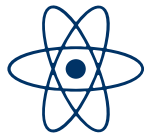
High variability of features

E.g. external mirror of Sprinter is offered in 130 variants



Complex and numerous methods of delivery to assembly line

From simple forklift to carset delivered by AGV



Restriction of space and time

Facility layout is not easy to change, pathways are shared by numerous transporter types and time is critical – delayed delivery can lead to assembly line stop which very costly



Complex assembly line requirements

In terms of maximum amount at line, quality, pre-picked items, “one touch – one motion”, etc..

Why Anylogic?

Spreadsheet style calculations can not consider:

- Complexity of delivery processes
- interferences between processes
- traffic conditions, dynamic vehicles speed
- availability of shared resources
- stochastic demand



Discrete-event simulation is right approach

The simulation software should offer:

- Discrete-event simulation framework
- Strong material handling functionality
- Support of programming language for custom developments
- Usage of external libraries
- Simulation cloud for collaborative experimentation



Modelling approach

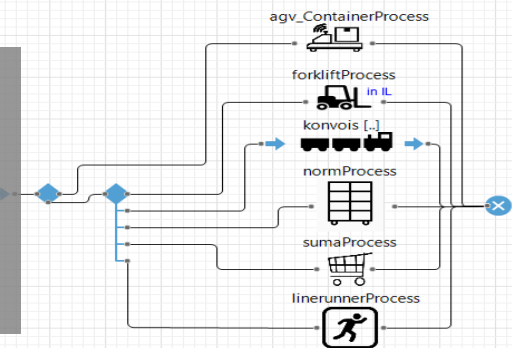
Layout is a parameter
Shopfloor layout DXF file is parsed
on start of simulation

Very low abstraction level

Every part number, location, transporter and order is an agent.
Model keeps track exact stock for every part number at every location. Excel input is feeding the model at start of simulation.

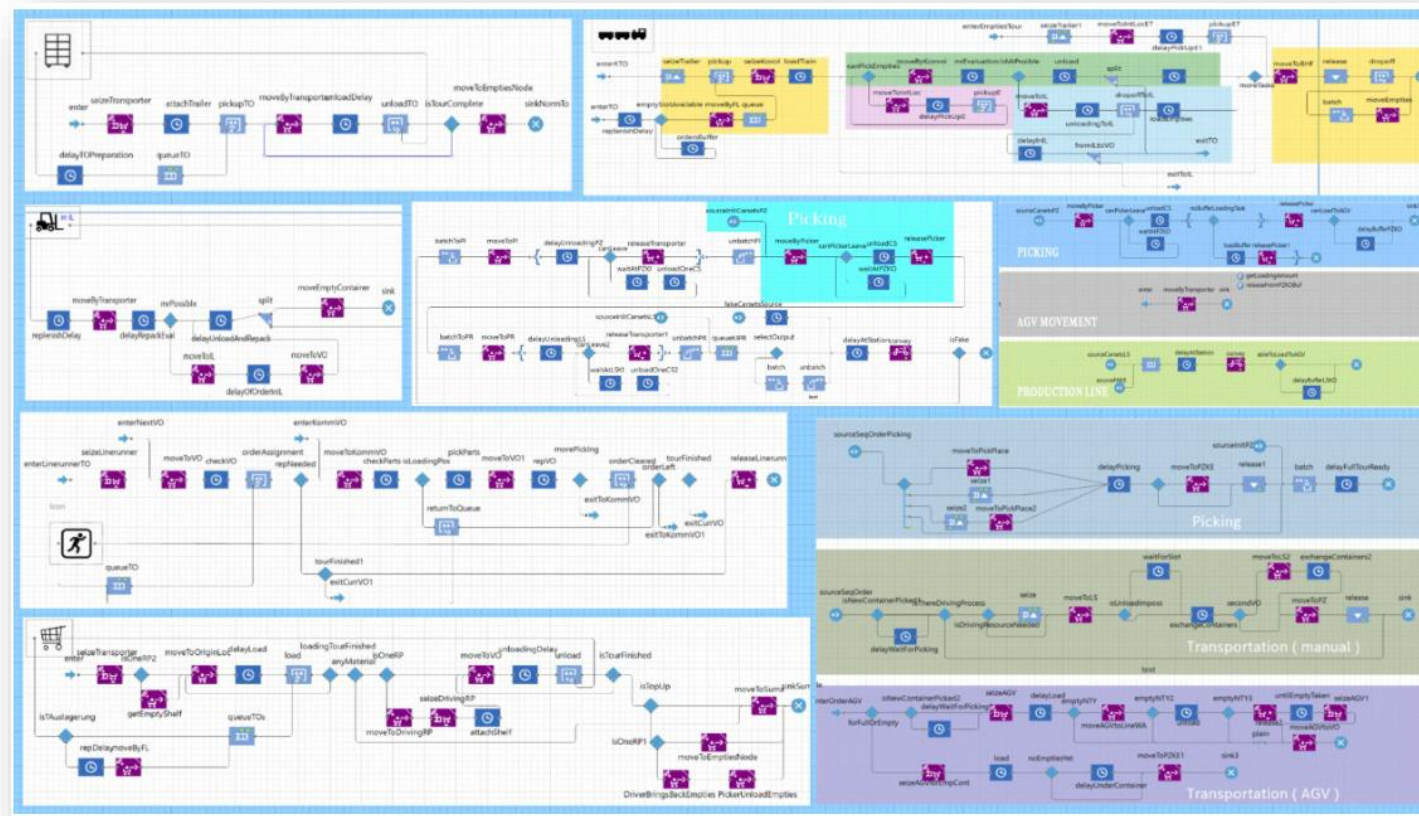
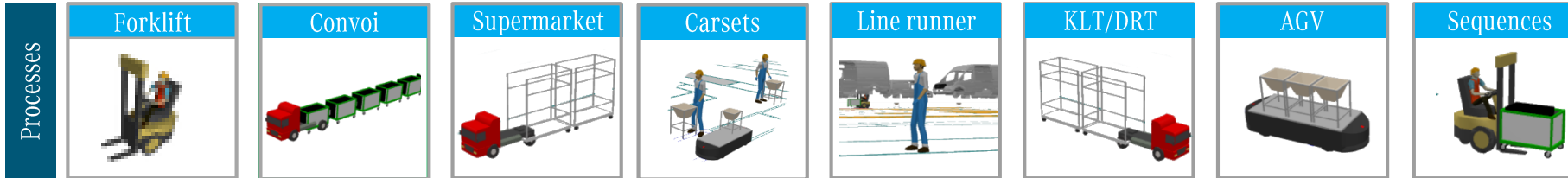
Modular design

Model was built in generic and modular way enabling scaling up the developed functionality



Flexibility,
scalability,
always actual data,
quick adaption to
changes

Modelling approach



Simulation demo

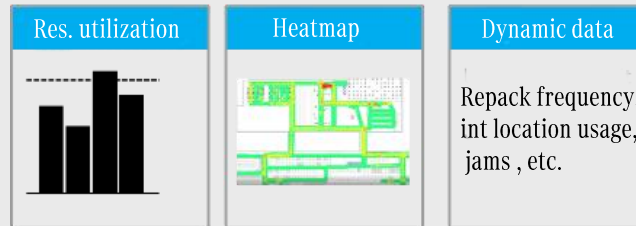


Simulation output

- Resources utilization by activity types, travelling distance
- Amount of containers per shift/location/route
- Routes utilization/distance/time
- Assembly line shortages
- Utilization of pathways
-
- Basically everything the planning engineer may want

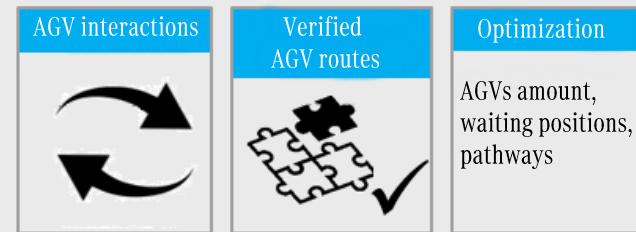
Simulation study results

1. Efficiency assesment for manual processes



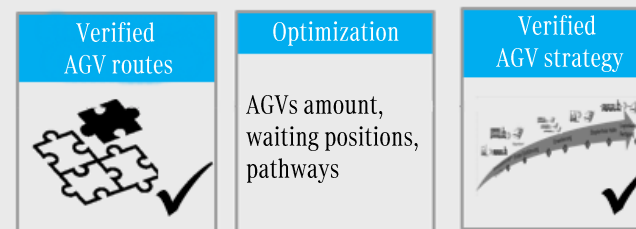
- Possible quick wins
- Input for process optimization
- System fine tuning
- Planning optimization

2. Support for AGVs implementation



- Verification of AGV routes
- Assesment of interaction between AGV and human-driven vehicles
- Confirmation for AGV investments
- Efficiency through automation

3. Vision: Fully automated shopfloor logistics



- Basis for following optimization projects
- Supports selection of most optimal implementation order



Q&A time