Online Control and Simulation (OSim)

Product Documentation

Version 1.0

The online simulation enables every Catena-X partner to simulate their own production using modern simulation techniques. In contrast to conventional planning and simulation tools, the simulation is made possible on a supply chain level. The simulation results of the company's own operations, together with the results of the other Catena-X partners, are fed into a simulation model as input and, taking into account both plannable and unforeseeable influencing factors, are iterated through as often as necessary until an optimal flow is created. This means that not only a vertical simulation but also a horizontal simulation (supply chain) can be carried out.

Scope

This product documentation, in conjunction with the OSIM-KIT release documentation (Tractus-X) and the OSim standardization (also on Tractus-X), represents the complete technical specification of the OSim use case. The standardization contents for the implementation of OSIm (currently only applies to the Partner Interface) must be adhered to and require certification by the Catena-X Association. The remaining contents of the product documentation, such as UI or simulation interface descriptions, or process specifications and data flows within the OSim Manager, should be seen as an implementation proposal.

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OSim Glossary

Abbreviation /Abkürzung	English	Deutsch
OSim	Online Control and Simulation	Online Steuerung und Simulation
OSim Manager	OSim Manager is the central CATENA-X application for the administration and application of the OSim use case.	OSim Manager ist die zentrale CATENA-X Applikation zur Administration und Anwendung des Use Case OSim.
DTOS	Digital Twin Operations Services Digital Twin Operations Services (DTOS) is a software product from Siemens for real-time simulation of material flows in production operations.	Digital Twin Operations Services Digital Twin Operations Services (DTOS) ist ein Software-Produkt von Siemens zur Echtzeit-Simulation der Materialflüsse der Produktionsbetriebe.
SCS	Supply Chain Suite Supply Chain Suite (SCS) is a software product from Siemens for optimising logistics processes.	Supply Chain Suite Supply Chain Suite (SCS) ist ein Software-Produkt von Siemens zur Optimierung der Logistikprozesse.
Normalized interface	Normalized interface for data exchange between OSim manager and simulation tools. "Normalisation" vs. "standardisation": By standardisation, we prefer to understand Catena-X standardisation. However, the interface between OSim Manager and simulation tools is not the subject of such standardisation. We therefore use the term "normalisation" for the connection of simulation tools via a uniform interface.	Normalisierte Schnittstelle zum Datenaustausch zwischen OSim Manager und Simulationstools. "Normalisierung" vs. "Standardisierung": Unter Standardisierung verstehen wir bevorzugt die Catena-X Standardisierung. Die Schnittstelle zwischen OSim Manager und Simulationstools ist aber kein Gegenstand einer solchen Standardisierung. Für die Anbindung der Simulationstools über eine einheitliche Schnittstelle prägen wir daher den Begriff "Normalisierung".
BPDM	Business Partner Data Management Management of Business Partner Leagal Entities, Sites and Addresses used to identify the Partners and their BPN-IDs for communication.	Business Partner Data Management Verwaltung von Geschäftspartner, Standorten und Adressen, die zur Identifizierung der Partner und ihrer BPN-IDs für die Kommunikation verwendet werden.
BPN	Business Partner Number A BPN is the unique identifier of a partner within Catena-x.	Business Partner Number Eine BPN ist die eindeutige Kennung eines Partners innerhalb von Catena-X.
BPNL	Business Partner Number Legal Entity	Business Partner Number Legal Entity

	A BPNL is the unique identifier of a partner within Catena-X, e.g. a company.	Eine BPN ist die eindeutige Kennung eines Partners innerhalb von Catena-X, z.B. eine Firma.
BPNS	Business Partner Number Site A BPNS is the unique identifier of a partner site within Catena-X, e.g. a specific factory of a company.	Business Partner Number Site Ein BPNS ist der eindeutige Identifikator eines Partnerstandorts innerhalb von Catena-X, z.B. einer bestimmten Fabrik eines Unternehmens.
IAM	Identity Identity Access ManagementAccess Management Identification and authorization of and for all partners, users, or assets which are involved in any interaction in Catena-X.	Identity Identity Access ManagementAccess Management Identifizierung und Autorisierung von und für alle Partner, Benutzer oder Anlagen, die an einer Interaktion in Catena-X beteiligt sind.
DS	Discovery Service Is a central registry used to store / lookup the EDC endpoints for OSim requests/sending.	Discovery Service Ist ein zentrales Register, in dem die EDC-Endpunkte für OSim-Anfragen/-Antworten gespeichert/nachgeschlagen werden.
SSI	Self Soverign Identity Hosting the EDCs certificates (public keys) used for mutual authentication between different EDC instances.	Self Soverign Identity Hostet die EDC-Zertifikate (öffentliche Schlüssel), die für die gegenseitige Authentifizierung zwischen verschiedenen EDC-Instanzen verwendet werden.
Basic Flow	Is the exchange of material flow simulation results over the network of OSim partners from lower to the higher tiers.	Ist der Austausch von Materialflusssimulationsergebnissen über das Netzwerk der OSim-Partner von der unteren zur oberen Ebene.
Scenario Flow	Is the exchange of material flow simulation results related to "What-If" scenarios.	Bezieht sich der Austausch von Ergebnissen der Materialflusssimulation auf "Was-wäre-wenn"-Szenarien.
"What-If" scenario	Describes potentially changed situations in production or changed requirements.	Beschreibt potentiell veränderte Situationen in der Produktion oder veränderte Anforderungen.
MaterialFlowSimulationResult	The MaterialFlowSimulationResult is the data model, which describes the structure of the simulation result data exchanged between OSim partners.	Das MaterialFlowSimulationResult ist das Datenmodell, das die Struktur der zwischen OSim-Partnern ausgetauschten Simulationsergebnisdaten beschreibt.
simulationRunID	The simulationRunID is the unique identifier of a simulation result.	Die simulationRunID ist der eindeutige Bezeichner eines Simulationsergebnisses.
MaterialFlowScenarioRequest	The MaterialFlowScenarioRequest is the data model, which describes the structure of the scenario data exchanged between OSim partners requesting a scenario based simulation run.	Der MaterialFlowScenarioRequest ist das Datenmodell, das die Struktur der Szenariodaten beschreibt, die zwischen OSim-Partnern ausgetauscht werden, die einen szenariobasierten Simulationslauf anfordern.

Introduction

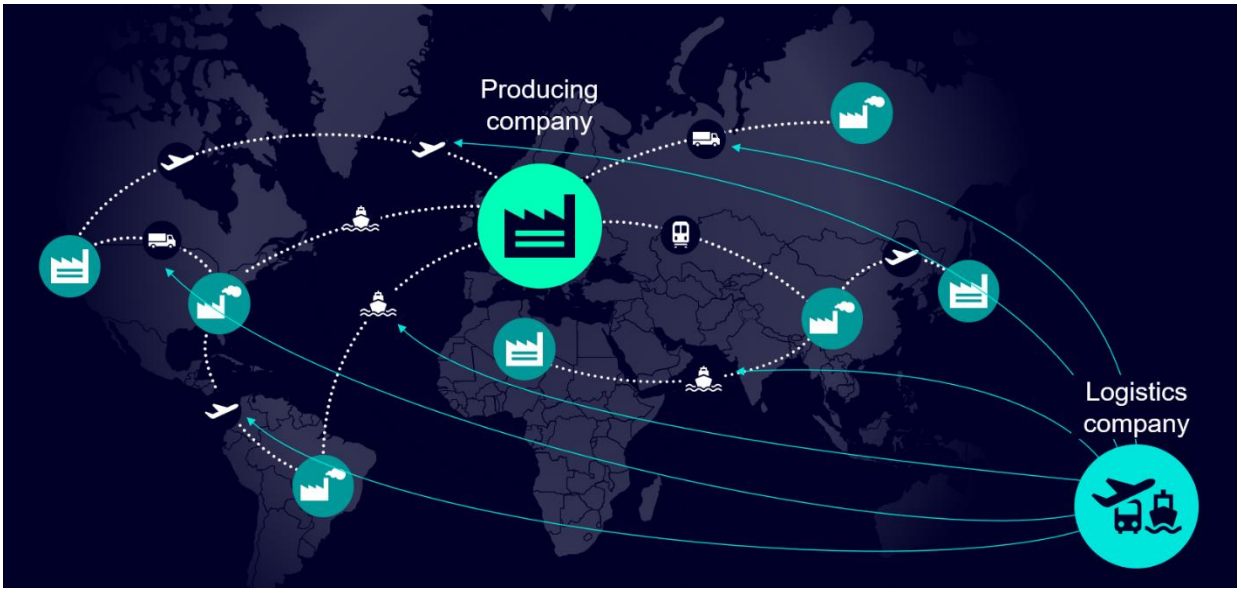
Vision

With a collaborative approach, Online Control and Simulation (OSim) enables each Catena-X partner to make transparent and evaluate the material flows and production operations of its own production, taking into account information and simulation results from upstream and downstream operations as well as inter-plant transports, using modern simulation techniques and AI methodologies.

Problem setting

The conventional standalone planning and simulation tools use as a basis only the planned values kept in their own systems (especially of the supplies), which can differ greatly from the actual values in reality. This can cause bottlenecks in intralogistics or lead to massive disruptions in production operations. Due to missing data exchange, the potential disruptions in the supply chain can not be taken into account.

Goals of OSim



Our collaborative approach OSim aims at simulating the behavior of the entire supply chain including the effects of potential disruptions. The simulation is not performed as a monolithic model, but in a distributed fashion in which each participant simulates its role, but receives information via OSim about relevant changes occurring in the network. Thus, influences on the own production, and vice versa effects of changes in the own production on participants of the supply chain, can be made explicit and evaluated with the simulation-based approach, as well as

iteratively improved across tier levels. At the same time, data protection and antitrust regulations are respected, since data is only exchanged according to the 1up-1down principle.

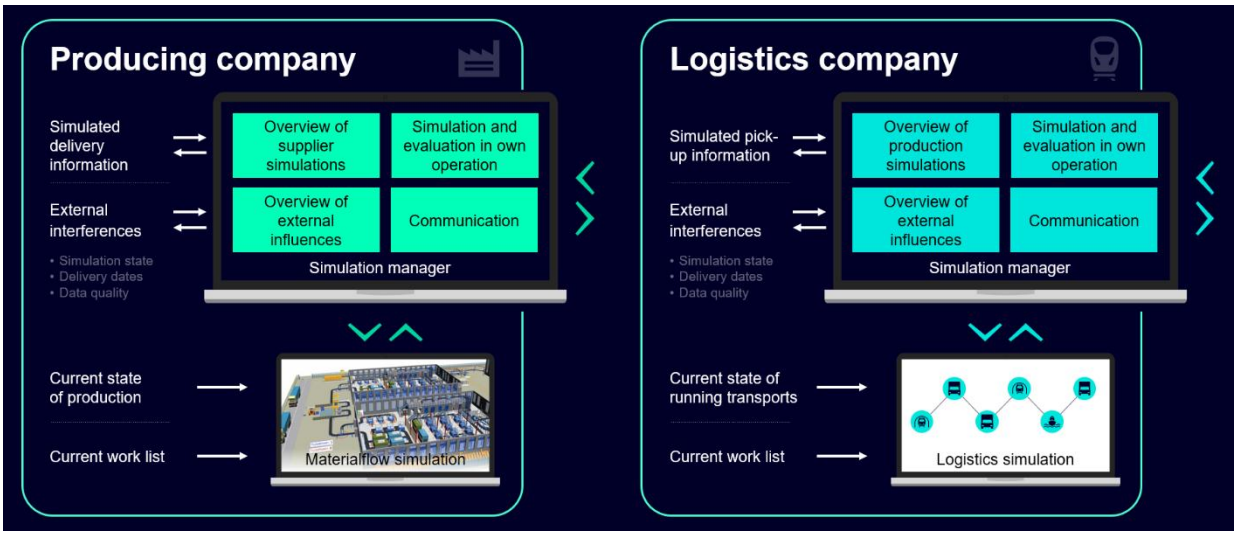
Target group

The target group is all OEMs, tier levels and logisticians in the supply chain.

Collaborative simulation offers a chance to react to changes in advance and thus to keep simulative planning up-to-date and one's own efficiency up. The added value of the networked simulations lies in the enlarged horizon of observation beyond the boundaries of one's own company and the automation of the inter-company exchange of information related to the simulated representation of the production and transport events.

Even companies that do not perform their planning with an in-depth simulation solution benefit from participating in OSim by being able to track and evaluate the state of the supply chain network and to pass on their own planning changes to their partners in a targeted manner.

Deliverables and project results



OSim is a software solution that uses simulation models to enable transparency and evaluation of material flows and production operations of one's own production, taking into account information from the supply chain. Central points of the solution are:

- The OSim concept or principal system architecture, whereby the individual components of the OSim solution are identified and described. These include:
    - The OSim Manager as a central application at each OSim participant, for managing, exchanging and evaluating simulation results in the supply chain, and for investigating improvement potentials by triggering own alternative simulation scenarios.

    - Production simulation and logistics simulation software, each of which receives as input from the OSim Manager the current simulation results of the other relevant network partners, and returns its results based on these to the OSim Manager.
- Standardized data model and format to be used as a basis for the implementation of the OSim manager prototype or possible future alternative implementations.
- Standardized interfaces through which simulation software (logistic and/or production simulation) can be coupled to the OSim Manager, and implementations of the OSim Manager can communicate with each other.
- Proof of concept of the OSim concept through a prototypical OSim Manager implementation using commercial software.

User Journey

The following questions are addressed in the chapters of the User Journey:

- Can I use OSim even if I do not simulate my production/logistics?
- What use cases and examples are there for OSim?
- What standards do I need to observe if I want to use OSim?
- What other tools do I need to be part of an OSim network?
- How do I set up an OSim node within the network for my company and what do I need from the EDC and Catena-X ecosystem?

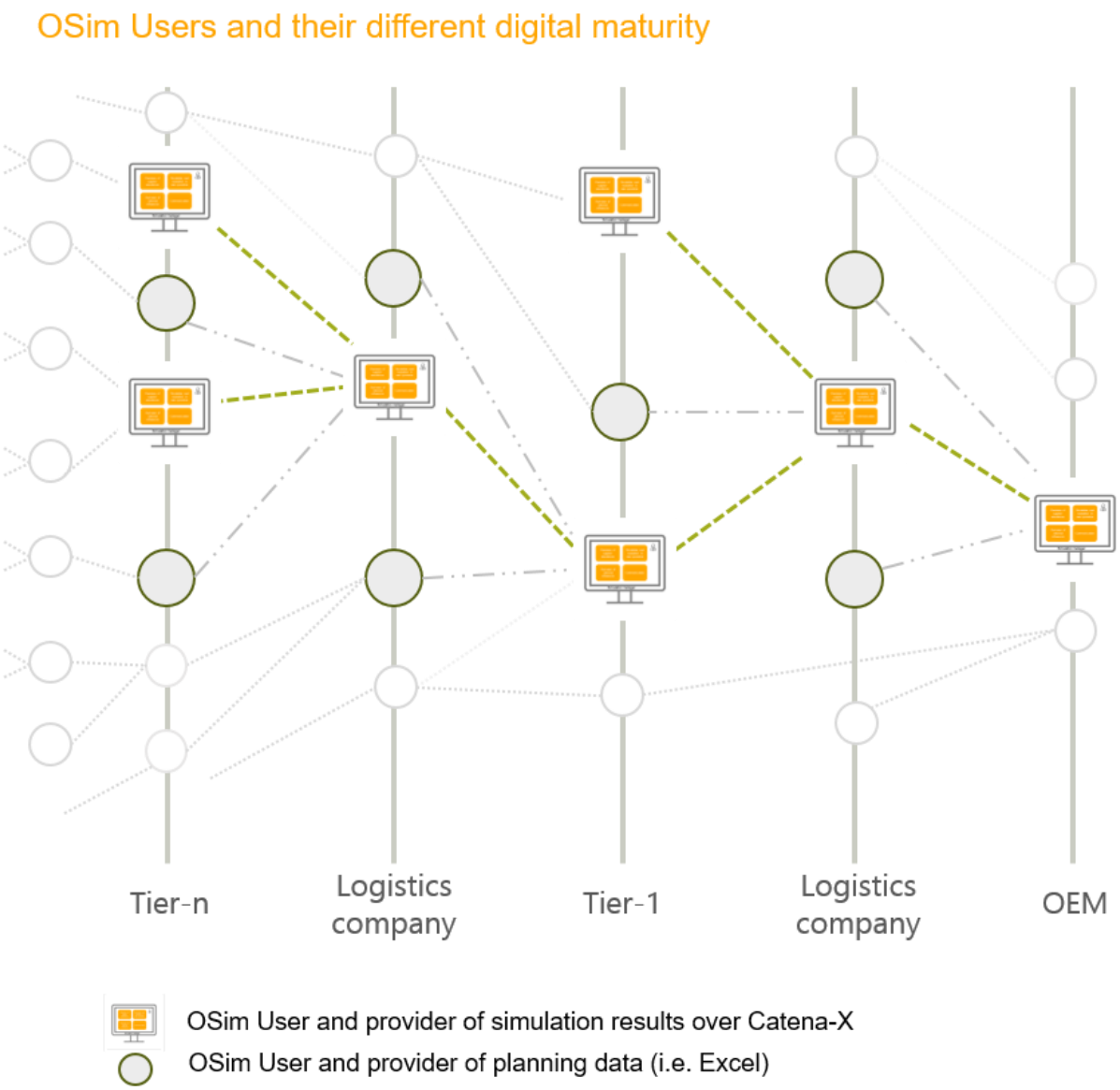
The User Journey refers to all topics related to OSim that are not connected to a direct implementation of the OSim concept for potential developers. For information on specific implementation as a developer, please refer to the "Developer Journey" section.

Everyone can get value out of OSim

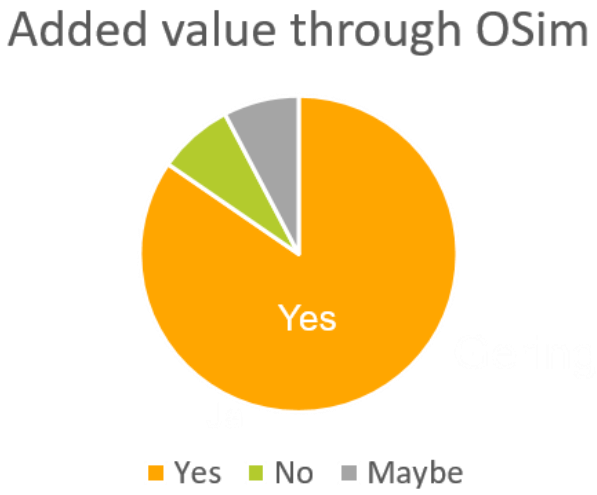
OSim offers added value for companies along the entire supply chain, regardless of their digital maturity. The OSim concept makes it possible to exchange existing planning data about your own production with suppliers and/or customers even without your own material flow simulation. OSim describes interfaces for importing data from various file formats and thus enables the use of Excel spreadsheets or similar for communicating planned deliveries.

In other words, as a company you can also view the planning data of a supplier that is not sufficiently digitized and request a new plan via a manager tool in the event of changing conditions or events.

The following picture shows the structure of a supply chain connected to OSim. Both companies with manual planning data and companies with simulation data are part of the network and thus create added value for themselves and the entire supply chain.



In two rounds of interviews with companies along the entire supply chain, the added value of OSim for a networked supply chain was clearly demonstrated. A total of 16 surveys were conducted. Both small and medium-sized enterprises (SMEs) and large corporations were surveyed. From raw material suppliers to logistics companies, Tier-X suppliers and OEMs, the added value of cross-company material flow simulation was confirmed.



The surveys also examined the digital maturity of the companies with regard to the use of production-related material flow simulations. Here it became clear that only a handful of companies already use simulations during production. Large companies in particular are more digitized in this respect than SMEs. Nevertheless, companies do not have the necessary digital prerequisites to support a complete and end-to-end simulation of the entire supply chain. Nevertheless, with the help of OSim, added value can be generated in each individual company by linking it with a supplier and/or customer. Thanks to the event and scenario-based concept of OSim, it is possible to react dynamically to unforeseen changes, even if these do not originate from the supplier's automated simulations. This leads to better planning and robustness of your own complex production or logistics.

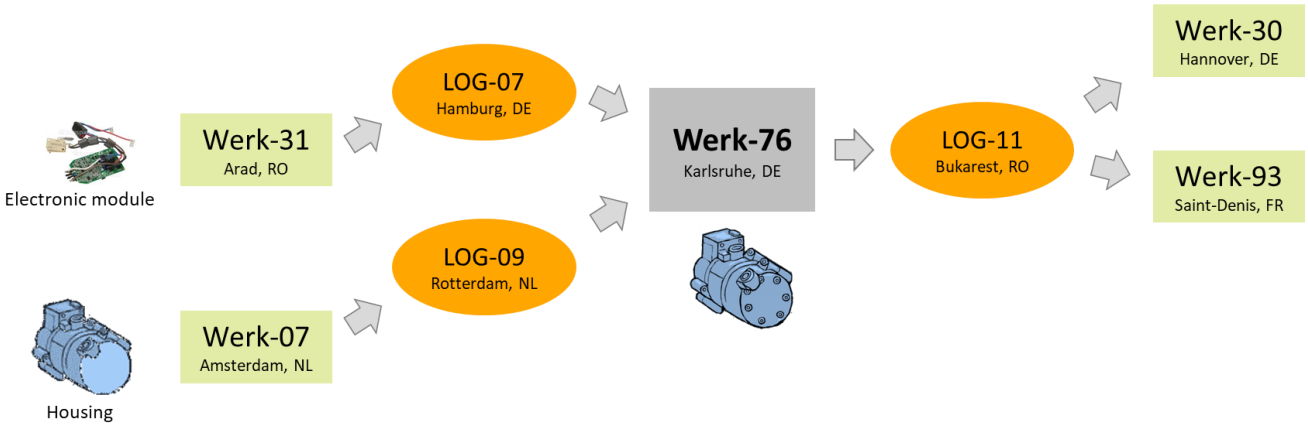
The added value of OSim is therefore already available in the smallest possible scenario (two companies and possibly a logistics service provider), regardless of the digital maturity of the companies involved. The OSim concept thus provides the basis for exchanging data on short-term changes, events or various production and logistics scenarios. This makes it possible for any company, regardless of its size and digital maturity, to participate in a networked supply chain. From a company's perspective, this starting point can be profitably expanded with more accurate forecasts, supported by in-house material flow or logistics simulations.

Use Cases and Examples

In order to guarantee a simulation of the entire supply chain, it is necessary to share simulation results from your own production or logistics with other partners within the supply chain. This is done strictly according to the 1-up-1-down principle. This means that only your direct supplier and customer (including associated logistics companies) can request your simulation results in order to protect data protection and antitrust law.

The following image shows a section of a possible supply chain. For the examples that follow in the text, we are looking at the role of a refrigeration unit manufacturer that supports Werk-76 in Karlsruhe. In accordance with the 1-up-1-down principle, I can only see my direct supplier and customer within the network. One of my suppliers manufactures electrical modules in Arad (Romania) in Werk-31, other manufactures housings for their units in Amsterdam (Netherlands) in Werk-07, both of which deliver parts to me with the help of logistics companies LOG-07 and LOG-09 (headquartered in Hamburg and Rotterdam). I deliver my finished refrigeration units to my customer in plant-30 in Hanover (Germany) and a customer in plant-93 in Saint-Denis (France) with the help of the logistics company LOG-11 (headquartered in Bucharest).

In order to better plan and simulate my own production or to be able to react to short-term events in production or similar, I can make enquiries to plants 07 and 31, as well as to the logistics companies LOG-07 and LOG-09, for simulation results of production and logistics there. In turn, I can make my simulation results available to the logistics companies LOG-11 and my customers in Plant 30 and Plant 93.



In general, OSim makes a rough distinction between two use cases:

- "Basic Flow" fulfils the purpose of a basic simulation and provides simulation results based on the current information of your own plant and the imported simulation results of predecessors in the OSim network.
- "Scenario Flow" fulfils the purpose of simulations that have to be carried out due to a scenario (e.g. machine failure, short-term staff absence, traffic jam, etc.).

Basic Flow

In the case of the "Basic Flow", a company itself carries out a simulation of its production/logistics and makes the results available in a database to the respective customer (including other intermediate logistics companies). The simulation is initiated by the company itself and the results are stored in a database so that the company's customer can request the simulation results.

Example

As a manufacturer of a refrigeration unit, I (Plant-76 in Karlsruhe) receive an inquiry from my customer (Plant-30 in Hamburg) about the planned delivery of 500 units tomorrow. The last simulation for this delivery is already outdated, so I, as an OSim operator, ask my simulation operator for current results of a material flow simulation of production.

As input for this simulation, I request current simulation results from my suppliers of the individual components (Plant-31 in Arad and Plant-07 in Amsterdam) as well as the associated logistics companies LOG-07 and LOG-09.

The simulation operator uses the input data to create current simulation results. These results are automatically forwarded to the OSim operator, who can then forward them to the intermediate logistics company to simulate whether the delivery can be carried out on time. The results of the logistics simulation are then sent to the customer in Plant 30 and the customer can complete his own planning.

This workflow can be automated in OSim Manager without the need to actively involve people in the company.

Szenario Flow

In the OSim environment, scenarios describe potentially changed situations in production or changed requirements that you want to communicate to the supply chain partners and have their feasibility confirmed.

In general, scenarios can be initiated by any partner involved in OSim (customers, suppliers, logisticians). The initiator is registered as a scenario owner in the system.

An important aspect of scenario management is the restriction of consideration to material flow segments. A material flow segment corresponds to a chain "1 supplier → 0:n logistician → 1:n customer". If an impact on other material flow segments is detected during analysis of a scenario, the viewer is responsible for whether the scenario is approved, forwarded, or rejected. An interweaving of different material flow segments is not supported for reasons of complexity. v

In scenario management, a distinction is made between 4 different scenario types:

- The data flow from the supplier to the customer
- The data flow from the customer to the supplier
- The data flow from the logistics provider to the customer
- The data flow from the logistician to the supplier

The data flows differ slightly depending on the company that triggers the scenario request.

Example "My supplier makes a scenario request"

My supplier Werk-31 creates a scenario in which it would only supply 400 electrical modules instead of 500 electrical modules and sends this scenario to me to check whether this change has an impact on the further supply chain. As described in the Basic Flow example, internal simulation results are created, and it is determined that stock levels can compensate for the missing 100 electrical modules and that there is no further impact on the supply chain. I therefore report back to my supplier that the requested scenario is possible.

Example "My customer makes a scenario request"

Since my customer has received an urgent order from Plant-30, he makes a request to me whether he can receive 100 more tomorrow in addition to the 500 required units. As an OSim operator, I make a request to my internal simulation operator, with changed input parameters (see Basic Flow for the process). The simulation shows that although the production capacity would be sufficient, there is a lack of housings to be able to carry out the delivery. I then submit a scenario request to my suppliers of the enclosures (Werk-07) as to whether 100 additional enclosures can be delivered tomorrow. This gives me positive feedback that this delivery is possible. I then report back in my customer's scenario request that the delivery of the additional units is possible.

Example: "An upstream logistics company makes a scenario request to me"

Due to short-term illness of the staff, an upstream logistics company reports a delivery delay of one day. I make a request with new input parameters to my simulation operator as described in the Basic Flow example. The simulation shows that my company can also deliver a day as a result. I make the results available to my customer, including the downstream logistics company, in the scenario request. My customer then reports back that a delayed delivery is not acceptable. I now have the option of hiring another logistics company that can take over the original delivery.

Example: "A downstream logistics company makes a scenario request to me"

A downstream logistics company makes a scenario request as to whether it can pick up the delivery for a customer a day earlier because a truck is already at work for another delivery. I make a request with new input parameters to my simulation operator as described in the Basic Flow example. The simulation shows that 400 of the 500 units can be picked up by the logistics company one day earlier. The scenario request is forwarded to the customer as to whether a delivery of the remaining 100 units can be delayed by a few days. The customer gives positive feedback, and the delivery adjustment can be carried out.

Which standards do I have to consider?

In order to enable secure and sovereign data exchange, corresponding standards and release KITs have been developed and published as part of the CATENA-X project, which describe the functions and data models that are exchanged via the interfaces.

The following standard is relevant when using the OSim Manager, which can be viewed on the website https://catena-x.net/de/standard-library:

- CX- 0133 Online Control and Simulation

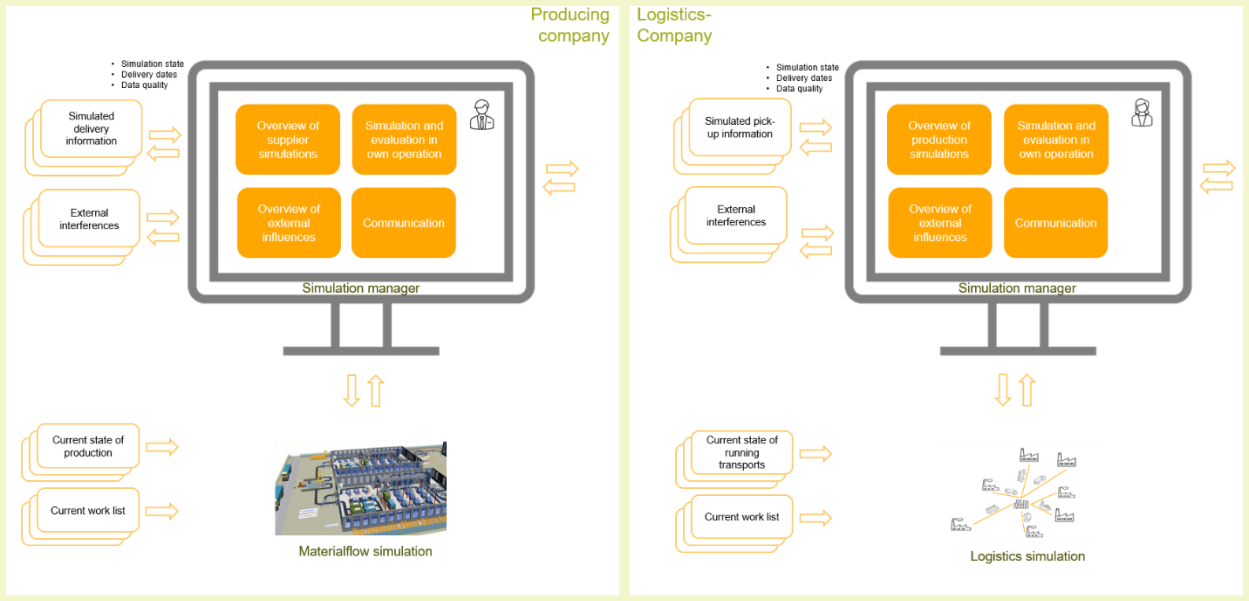
This defines the data model, APIs and processes for inter-company data exchange.

In addition, a so-called OSIm-KIT provides an explanation of the functionality and use of the functions and data models for data exchange between different OSim Manager instances by means of the two Adoption and Developer Views on Eclipse Tractus-X (https://eclipse-tractusx.github.io/docs-kits/category/osim-kit).

Which tools do I need to use?

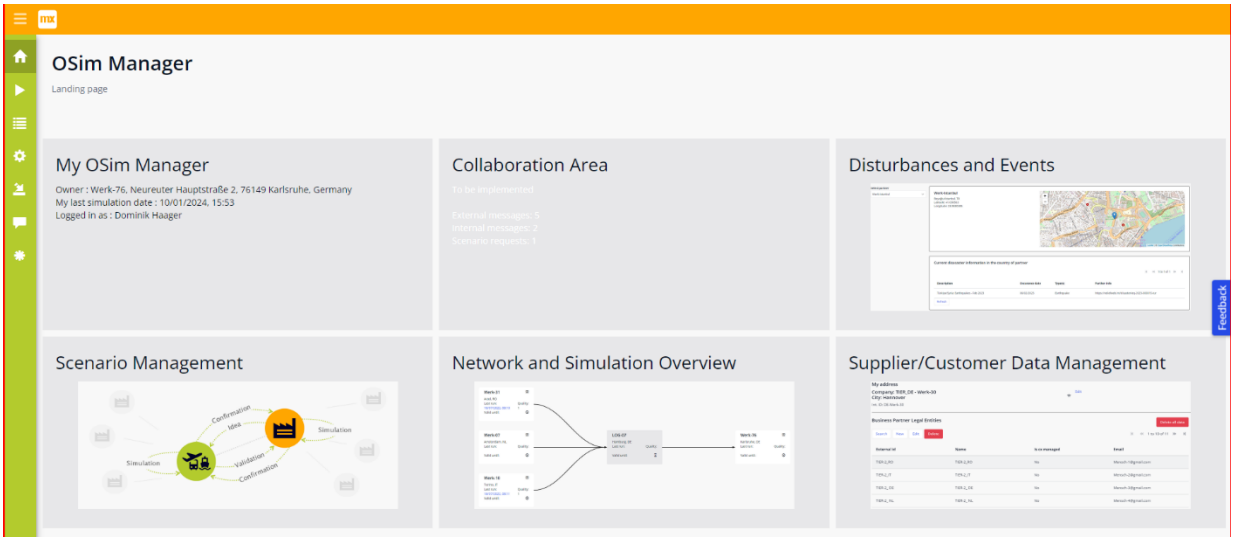
OSim Manager Application

The OSim Manager is a software application that exchanges and collects all the information required for a local understanding of the supply chain with the partners and simulation tools and prepares it for the user. The OSim Manager is based on the interfaces and standards described in the "Developer Journey". Although there is a reference implementation in the course of the Catena-X project, every company is free to implement its own OSim Manager according to its own needs. The following section discusses what an OSim manager can do based on the reference implementation and what needs to be considered when implementing your own.



Functionality of the OSim Manager

The reference implementation of an exemplary OSim Manager was carried out within the Catena-X project using the low-code programming language Mendix. Implementations in other programming languages are also possible. For reasons of availability and ease of updating, the program was implemented as a web application to which OSim users log in with a password. A separate copy of the OSim Manager with its own data storage is started for each partner in the supply chain. After logging into the application, the user is taken to the start page, from which all important functions can be accessed.



Clockwise from the top left, the following functionalities are available:

- "My OSim Manager" provides basic information such as the identity of the supply chain partner operating this OSim Manager or its most recently performed simulation.
- Messages can be sent and received messages can be read and evaluated in the "Collaboration Area". Messages can be internal (generated from the OSim Manager) or external from the simulation tool or supply chain partners.
- Under "Disturbances and Events", external events that could be relevant for the operation of the supply chain can be provided. For test purposes, raw material prices, traffic data and information on natural disasters are currently retrieved and tailored to the operator.
- "Supplier/Customer Data Management" allows the creation and management of master data for all partners who could act as suppliers, customers or logistics providers for the operator (see next section).
- "Network and Simulation Overview" leads to a graphical representation of the 1-up/1-down neighborhood of the operator's supply chain, from which this supply chain can also be managed. The tiles of individual partners in the supply chain can be used to display their latest simulation results or request current simulations.
- Under "Scenario Management", "What-if" scenarios can be configured and managed in order to examine hypothetical changes to the production/logistics process together with the partners.

A separate instance of OSim Manager runs for each partner in the supply chain ("operator") with its own data model stored in a relational database.

Für jeden Partner in der Lieferkette („Betreiber“) läuft eine eigene Instanz des OSim-Managers mit einem eigenen in einer relationalen Datenbank gespeicherten Datenmodell.

- **Partner master data**
  The master data of all potential partners of the operator (suppliers, customers, logistics providers) in the supply chain can be imported, edited and displayed in the OSim Manager. The structure of this data corresponds to the "Business Partner Network" (BPN) structure specified by Catena-X:
  - A company is represented as a "Business Partner Legal Entity". It has the typical attributes such as name and contact details. If the company is a Catena-X partner, this entry is managed directly by Catena-X.
  - A legal entity can have several "sites", which represent locations of the company. A "Business Partner Site" (BPNS) is used in OSim as a site reference.
  - A site can have several addresses. Only these represent an actual postal address of a plant. In reality, a "Business Partner Address" (BPNA) represents a plant gate, for example.

- **Structure of the supply chain**
  The actual supply chain of the operator can be configured from the list of business partners, restricted according to the 1-up/1-down principle:
  - The supply chain consists of a list of "Network Pairs"
  - Each network pair represents either an upstream or a downstream branch
  - A network pair includes a logistics partner, a manufacturing partner, or both.

- **Simulation results**

  Simulation results represent the operational plans of the supply chain partners that affect the supply chain process. This means that they contain information about when which goods are made available where or transported from where to where. All simulation tools that are to be compatible with OSim must make their simulation results available in this form and be able to process input data in this form.

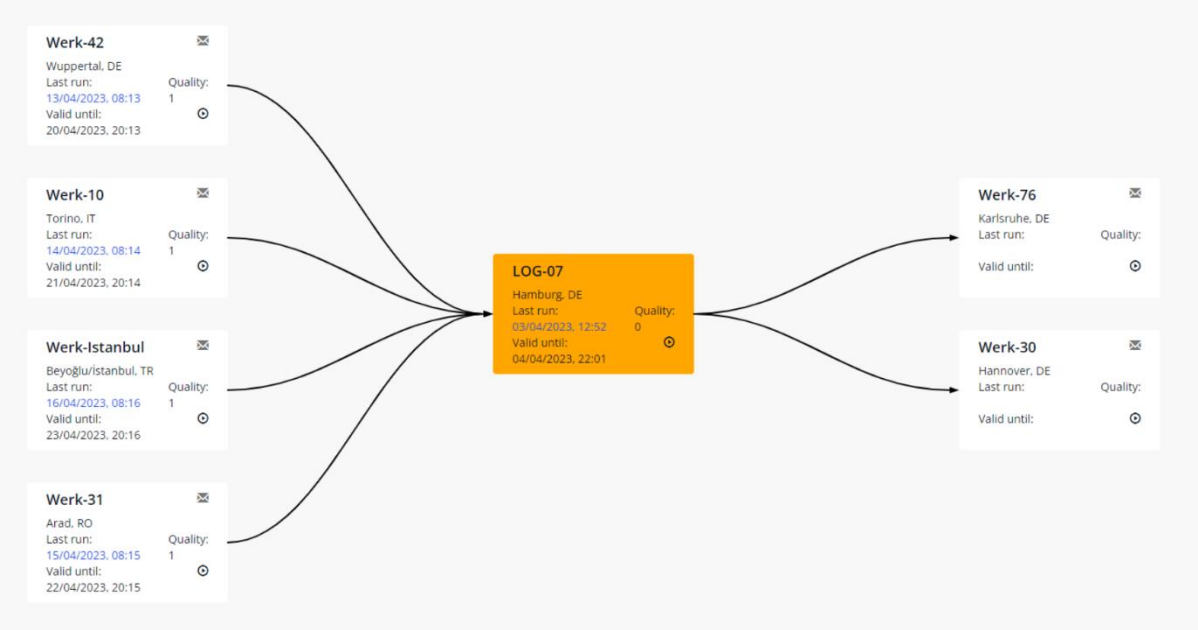
  - A "simulation run" represents a simulation result of a partner, with attributes such as generator or timestamp of the simulation.
  - A "simulation run" includes "shipments", i.e. deliveries from one BPNA to another, possibly carried out by a logistics provider who is also identified by a BPNS + BPNA.
  - A "shipment" includes "handling units", which represent the smallest unit to be transported (e.g. a pallet), with logistically relevant properties such as dimensions and weight.

- A "handling unit" contains "material batches" that identify the goods actually transported, with description, number and reference to order and material numbers.

Master data management and partner network

In master data management, the user is enabled to view and manage various information from the previously presented data model. The partner network can also be configured and adapted and viewed. To do this, it must initially be known which suppliers, customers and logistics companies are in a direct relationship with one's own company. The network itself can be built directly graphically. The focus is always on the company's own business, the connection of which can be expanded with the help of a configuration menu.

From this information, a graphical overview of the supplier network is then generated. In the middle, your own node is displayed, highlighted in color. To the left and right of it, all linked partners dynamically connect.



As can be seen in the example image, tiles of the individual partners can also contain functionalities to communicate with the corresponding partner, request a released simulation result (or, in the case of your own node, send a simulation request to your own simulation tool).

Simulation results that have already been received can also be viewed and managed. When accessing via the network view, the user is taken directly to the detailed view of the simulation result. This provides an overview of the origin of the data set. Own simulations can be released using the "Release Simulation" function. It then lists all deliveries that are included in the record. To get detailed information, these deliveries can be opened. The operator then receives information about the packaging material used and the materials it contains.

OSim Manager Interfaces

In order to be able to use the previously presented functions, two interfaces are required. On the one hand, the "Simulation Interface", which handles the data exchange between the simulation tools and the OSim Manager, and the EDC Interface, which enables the exchange of data between participating partners within the supply chain.

Logistics simulation

Logistical networks are complex systems whose processes are influenced by numerous external and internal, partly stochastic factors, e.g.:

- the current traffic situation
- the volume of consignments (quantity, volume, weight, ...)
- the network design (timetables, sorting capacities at transshipment points, ...)

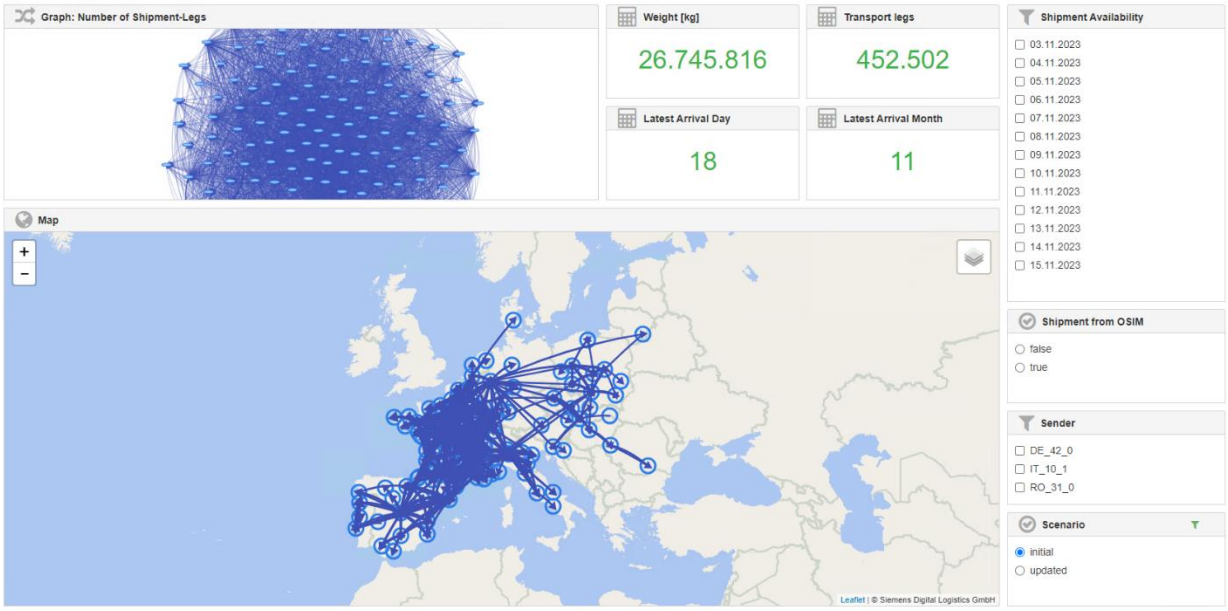
The simulation of these networks can help to analyse which effects external influences and the network design itself (as well as changes to it) have on the operation.

The term "simulation" is understood in the context of planning, controlling and optimising logistics operations as discrete event simulation.

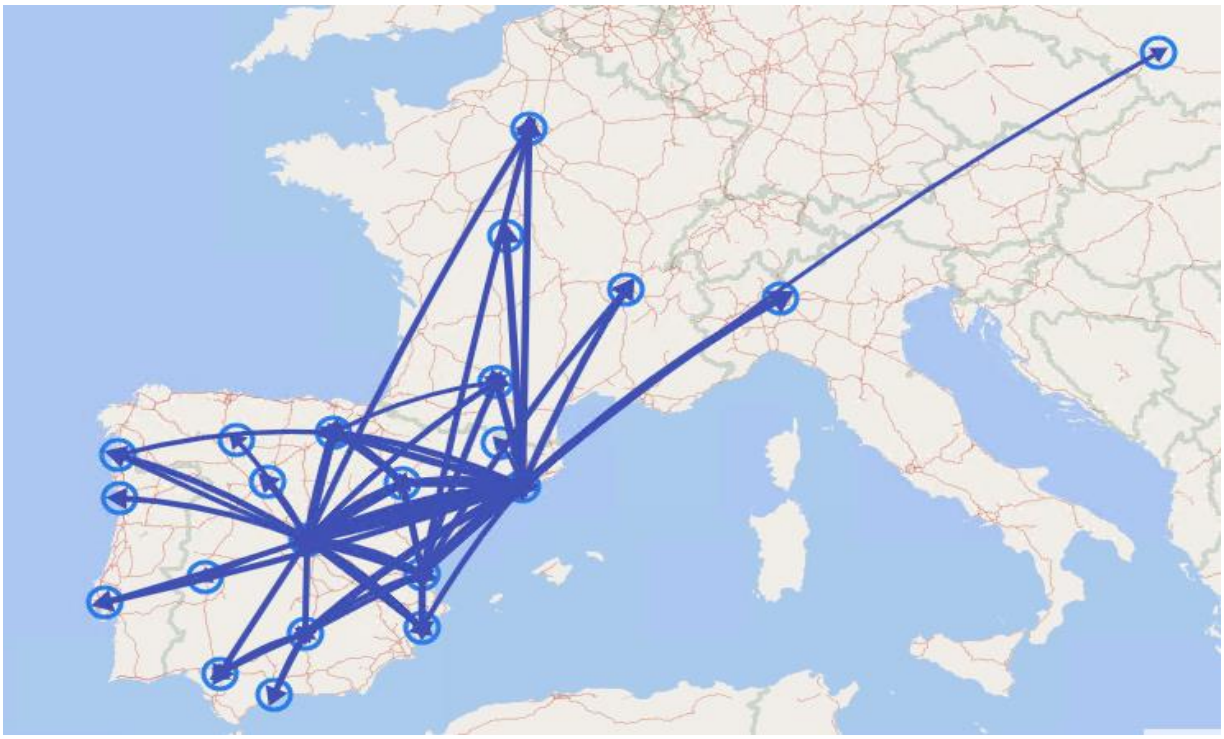
For a given consignment structure, with given external influences as well as the components of the network, the flows of consignments through the network are simulated.

Here, the entire network must always be taken into consideration, as network effects can lead to changes of volume flows in areas that are not directly affected by any scenario related changes.

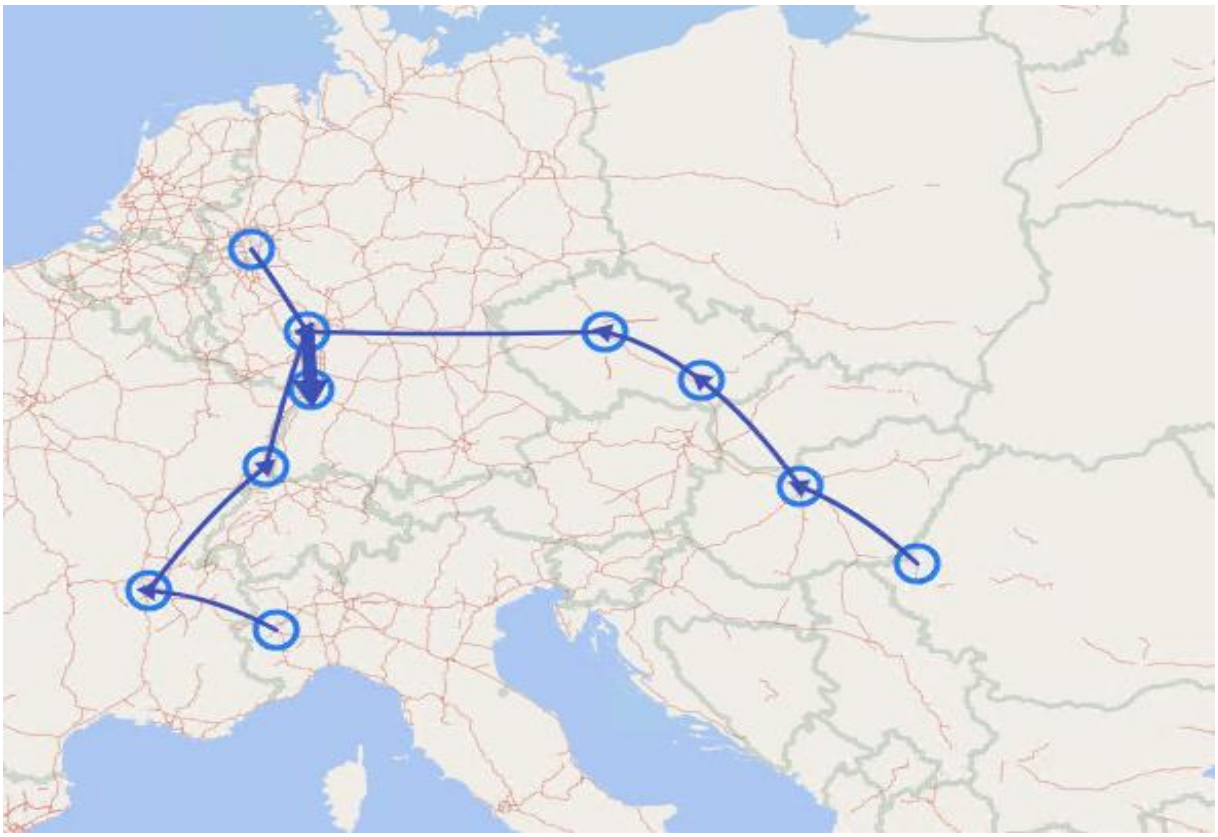
The following example shows how the entire cargo network of a logistics service provider can be simulated using Siemens Supply Chain Suite.



Drill down based on different filters allows for detailed analysis of different subnetworks.



This can be taken to the extent that flows to a specific recipient or from a sender, including associated transportation and handling, can be analyzed.



Relevant results for the operation of logistical networks can be derived from various simulation runs that depict different scenarios, e.g:

- Vehicle utilisation
- Position of goods at any time in the network
- utilisation of sorting capacities
- Bottlenecks

A wide variety of properties can be taken into account and changed in the scenarios, for example (incomplete)

- Consignment structure
  - Pick-up location, destination
  - Date/time of availability
  - Weight, volume
  - Product (standard, express, ...)
- External influences
  - Congestion
  - Machine breakdowns (sorting)
  - Breakdowns (vehicles)
- Network
  - Timetables

- Routing of consignments
- Sorting capacities

In the context of OSim, the central objective is to determine the expected delivery - when how much will be delivered to which location. This information is provided as input for downstream production simulations.

Production simulation

Production facilities are complex systems whose processes are influenced by numerous external and internal factors, some of which are stochastic. It is not trivial to answer questions such as:

- Will I fulfil my customer orders as planned?
- What is the outlook for my production capacity utilisation?
- How does a delayed delivery of raw material affect the completion date of a particular order?
- Can a machine breakdown be compensated for by additional employee capacity?
- A new order has to be processed at short notice. Does the sequence of already scheduled orders have to be adjusted to avoid waiting times and machine downtimes?

Production simulations can help find answers to these questions. They imitate the components of a production and the material flow through the system. Dependencies are also taken into account, such as the sequence of process steps required to manufacture a product or the availability of employees to operate machines. If necessary, adjacent areas are included in the simulation model, e.g. a warehouse.

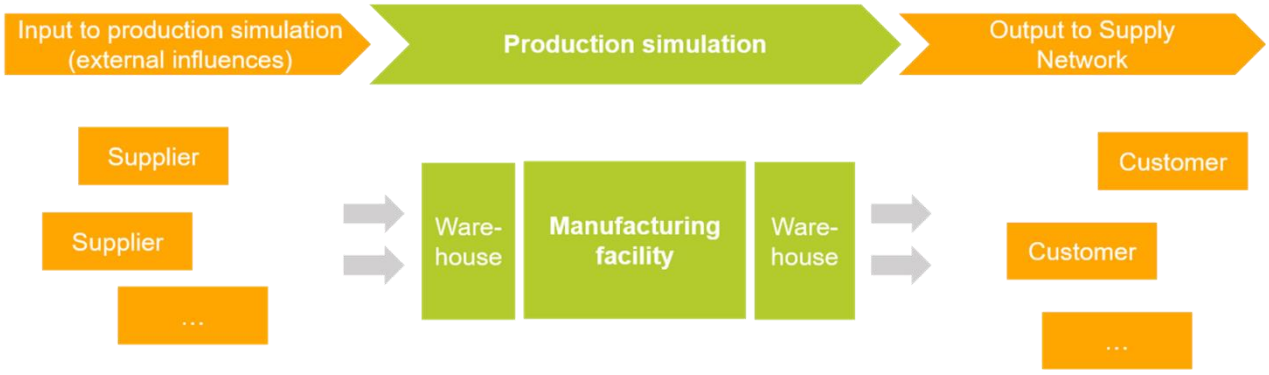


Fig: Simplified, company-centric visualization of the production simulation system and the system environment

In the context of planning, controlling and optimising production processes, the term "simulation" is often understood as a discrete event simulation. In a broader sense, a production simulation is a simulation of a production system and its behaviour over a period of time that can be used to investigate the issues described.

There are currently several simulation solutions on the market, e.g. :

- A commercial simulation software (Tecnomatix PlantSimulation, AnyLogic, Simio, ...)
- A spreadsheet program (OpenOffice Calc, Google Sheets, Excel, Numbers, ...)
- A company simulation (e.g. implemented in a higher programming language

Production simulations can be used at different times and with different objectives. These include:

- Greenfield/brownfield planning of a production facility
- Adaptation and optimization of the production processes (e.g. in the case of a far-reaching change in the production program)
- Cyclically repeated simulation during production
- Regular review of control strategies and validation of production alternatives

The requirements for the simulation model depend on the particular use case.

OSim is clearly aimed at the repeated use of simulation to evaluate different production alternatives. The solution used by the company in connection with OSim should therefore be suitable for modelling different scenarios and calculating them in a reasonable amount of time.

EDC Connector Application

The Eclipse Dataspace Connector (EDC) is the enabling component for all use cases within Catena-X and the only component that performs the exchange of operational data with Data Space participants. The basic use case is the exchange of data between network partners.

The major benefit of the EDC is ensuring trust, interoperability and data sovereignty in sustainable peer-to-peer data exchange between organizations and companies. Whoever contributes data to the Catena-X data space via EDC retains control and decides individually who, how, when, where and under what conditions is involved in the data exchange. A corresponding concept was developed within the framework of Gaia-X and the International Data Space Association.

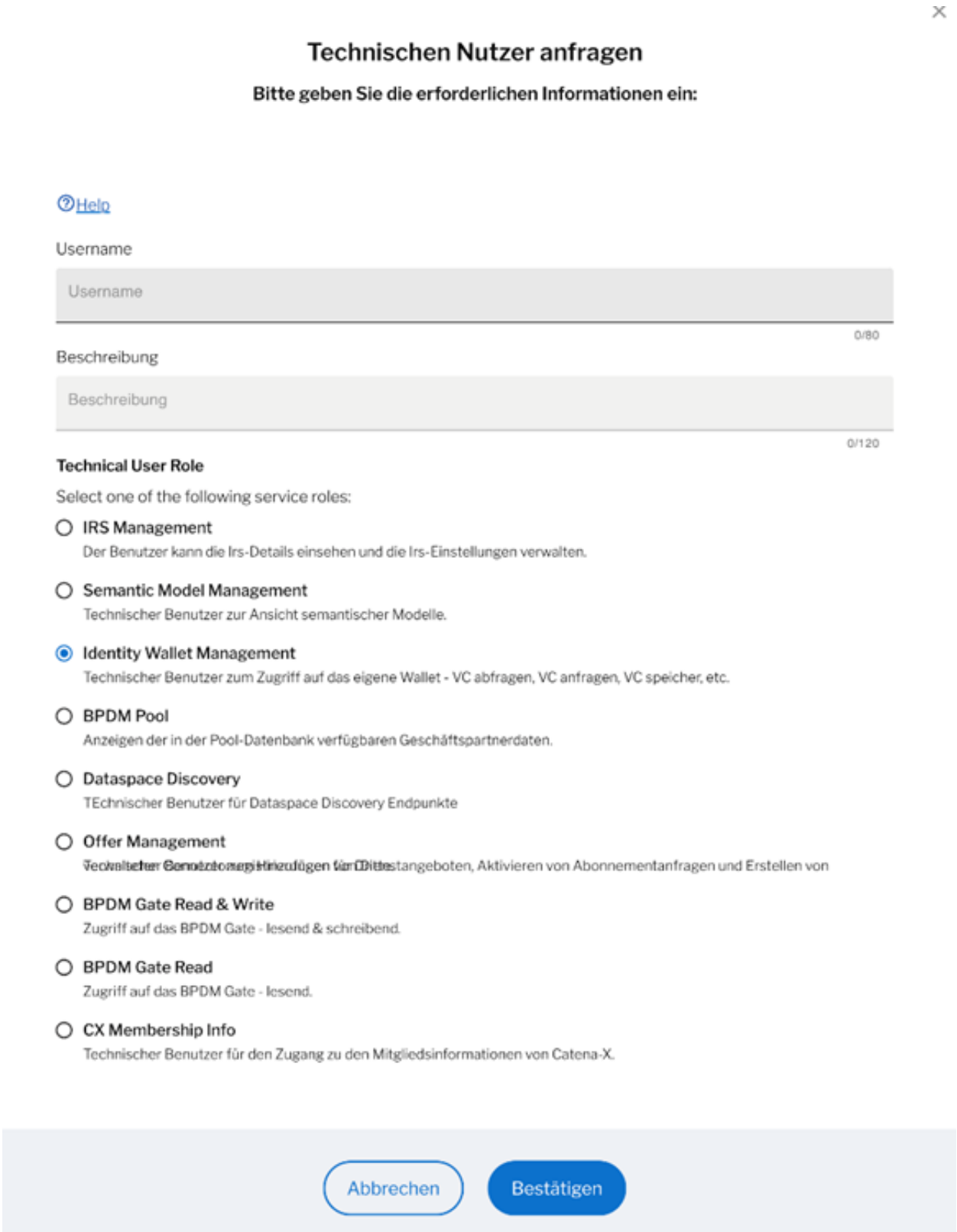
More detailed information on the EDC can be found at the following link: https://eclipse-tractusx.github.io/docs-kits/category/connector-kit

What do I need from the EDC / Catena-X ecosystem?

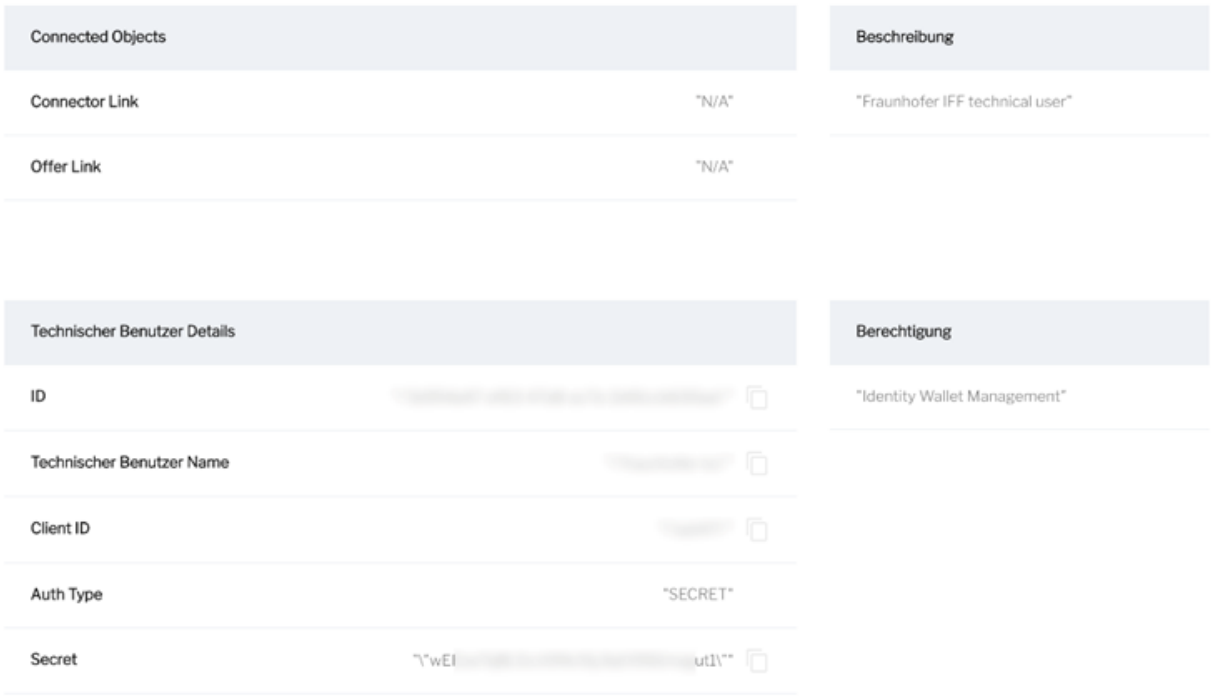
As described in the previous section, the EDC Connector is used for the cross-company exchange of data between different instances of OSim Manager. On the one hand, this requires at least one EDC Connector to be set up and made available in both companies and, on the other, onboarding to these central services in order to use the EDC Connector, which in turn uses central services for authorization and authentication.

Onboarding takes place via the CATENA-X portal. For this purpose, a request must be submitted to the Catena-portal team, which provides an invitation link via which the company-specific data and then the data of the first administrative user must be entered. After successful registration and approval by the portal team, the company is registered and receives its own BPNL (Business Partner Number Legal Entity).

After successful onboarding, a technical user must be created on the portal, which is used in the EDC Connector in its own instance for authentication and authorization to the central services and must be stored in the configuration of the EDC Connector. The technical user requires a special role (Technical User Role), which must be selected when creating the user account: Identity Wallet Management.


Technischen Nutzer anfragen
Bitte geben Sie die erforderlichen Informationen ein:
Help
Username
Username
0/80
Beschreibung
Beschreibung
0/120
Technical User Role
Select one of the following service roles:
IRS Management
Der Benutzer kann die Irs-Details einsehen und die Irs-Einstellungen verwalten.
Semantic Model Management
Technischer Benutzer zur Ansicht semantischer Modelle.
Identity Wallet Management
Technischer Benutzer zum Zugriff auf das eigene Wallet - VC abfragen, VC anfragen, VC speicher, etc.
BPDM Pool
Anzeigen der in der Pool-Datenbank verfügbaren Geschäftspartnerdaten.
Dataspace Discovery
TEchnischer Benutzer für Dataspace Discovery Endpunkte
Offer Management
stangeboten, Aktivieren von Abonnementanfragen und Erstellen von
BPDM Gate Read & Write
Zugriff auf das BPDM Gate - lesend & schreibend.
BPDM Gate Read
Zugriff auf das BPDM Gate - lesend.
CX Membership Info
Technischer Benutzer für den Zugang zu den Mitgliedsinformationen von Catena-X.
Abbrechen
Bestätigen

Once the technical user has been created, their credentials, which are required to configure the EDC Connector, can be read out on the portal.



How do I set up my OSim node?

An OSim node includes the following components: EDC Connector, OSim Manager and a simulation tool. The following chapters provide a rough description of the procedure or refer to further information. In addition, the installation routines differ depending on the software provider of the applications. Please refer to the relevant sources.

Putting the EDC-Connectors into operation

The EDC Connector is implemented as a service, which is controlled via a REST API using HTTP from the OSim Manager.

In the simplest case, an EDC Connector is put into operation on a Kubernetes cluster. For this purpose, the EDC team provides corresponding HELM charts in which the access data of the technical user, the BPNL of the company and the URLs for public access (configuration of the Ingress Controller) must be specified. See https://github.com/eclipse-tractusx/tractusx-edc/blob/main/charts/tractusx-connector/README.md

The step-by-step explanation of the commissioning of the EDC Connector can be found in the associated repository of the tractusx-edc (https://github.com/eclipse-tractusx/tractusx-edc).

Der EDC Connector ist grundsätzlich als Service implementiert, welcher über eine REST API per HTTP aus dem OSim Manager heraus gesteuert wird.

Putting the OSim Managers into operation

Note: The following description is merely a rough schedule of the steps to be carried out, regardless of the manufacturer-specific variant of the OSim application!

The great added value of Catena-X is that applications from different software providers will be available and can exchange data with each other thanks to the standardized interfaces. This gives each network participant flexibility in the selection of apps, and in this case the OSim Manager.

Once the app has been installed (please follow the manufacturer-specific installation instructions), the first step is to maintain the master data relating to the partner network.

- suppliers,
- Logisticians for the transports from the suppliers,
- Logisticians for the transports to the customers,
- customers.

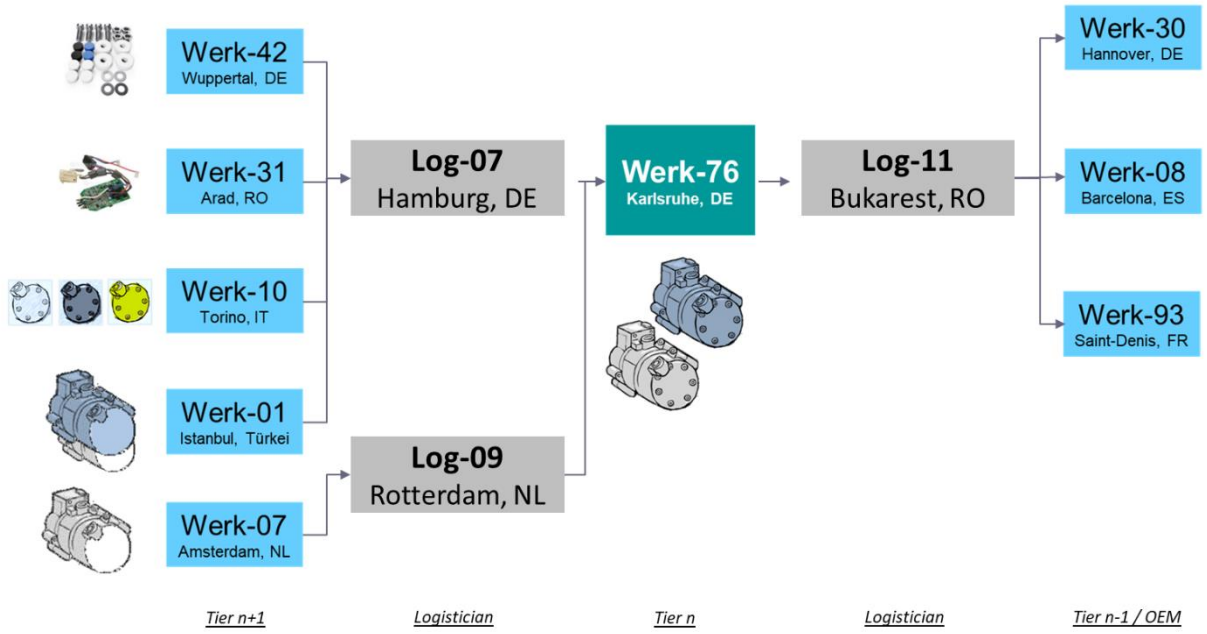
Each partner is configured with 3 hierarchical entities in the OSim Manager. These are:

- Company,
- location and
- address.

If these partners participate in the OSim Use Case (are registered in the Catena-X portal), the data exchange can be supported by Catena-X central services. As the unique identification of each registered partner is carried out using BPN numbers, these can be obtained for each partner from the Catena-X portal. Depending on the design of the OSim Manager, the BPN numbers are stored in the OSIm Manager or obtained each time at runtime.

Following the general Catena-X data sovereignty principle, a partner's view of the supply chain is limited to direct suppliers and customers (also known as the one-up-one-down principle). This means that the configuration of your own network is always carried out by specifying the starting point (i.e. your own plant) and then linking to the plants of suppliers and customers. In addition, the logisticians responsible for the respective transportation must be configured.

The following figure shows an example of a network from the perspective of "plant 76" with five suppliers, three customers and the associated logistics providers.



Finally, the link to the previously installed EDC Connector is created in the OSim Manager. See the manufacturer-specific documentation for the OSim Manager.

Preparation and commissioning of a simulation tool

The OSim concept provides two alternatives for exchanging simulation data with the OSim Manager:

- Automated via a REST-API interface with a simulation tool
- Manually using Excel files

Automated data exchange is based on the use of a simulation tool that can retrieve input data and feed the simulation results back to the OSim Manager.

The simulation tool must therefore completely map the material flow of the company's own operations.

In production operations, from goods receipt, internal logistics and production to packaging and goods provision. In logistics operations, from goods acceptance and transportation to delivery at the destination. It is important that the transfer points, such as goods receipt and goods provision at the producers, as well as goods acceptance and delivery at the logistics providers, are modeled particularly accurately, as this results in the interface information of the OSim use case:

- The simulation results of the OSim network predecessors are the input parameters for the simulation model.

- The information about the provision of goods, such as material including packaging units, quantity and the predicted time correspond to the simulation result of the simulation itself.

When modeling the internal logistics or production area, the level of detail can remain coarser, as this information is not relevant in terms of the OSim use case.

Simplified **manual** data exchange is based on the direct import of data in the form of Excel files using OSim Manager UI. In this case, the use of a simulation tool can be dispensed with and the data can be obtained from a detailed planning tool, for example.

Note: The exact specification of the interface to the simulation tools in both variants can be found in the technical section of this documentation.

Developer Journey

OSim Manager

The OSim Manger is a program to connect different OSim participants within the CatenaX Network.

Architecture of OSim

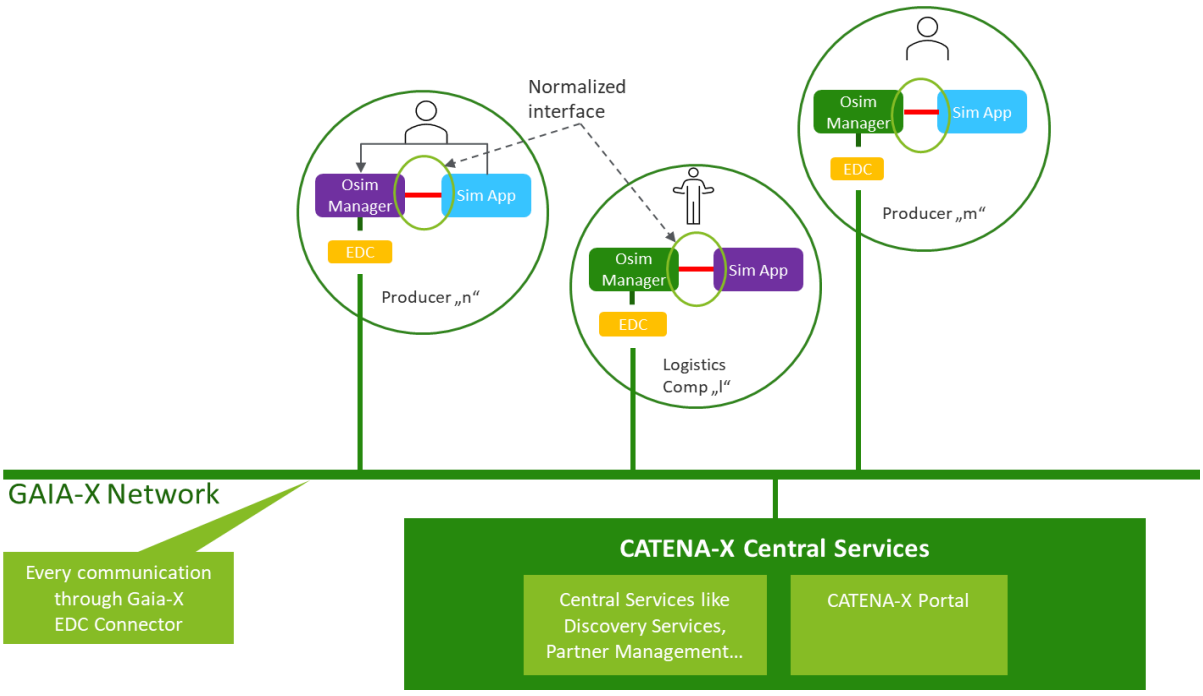
The OSim solution is based on an architecture in which the central CATENA-X services and OSim components work together. The most important OSim application is the OSim Manager, followed by simulation tools for logistics and production.

The OSim Manager is the central application for managing, exchanging and evaluating simulation results in the supply chain for each OSim participant (customers, suppliers and logistics providers). Data is exchanged between the OSim Manager instances of the partners via a standardized REST-API interface, which is based on the central Catena-X services for unique identification and secure communication. A separate EDC connector is used as the transmission layer.

Partner-internal communication with their own simulation tools is preferably based on the normalized REST-API interface.

Note: "Standardization" refers to the "Catena-X standardization". However, the interface between OSim Manager and simulation tools is not the subject of such standardization. The uniform interface used to connect the simulation tools is therefore referred to as "normalization".

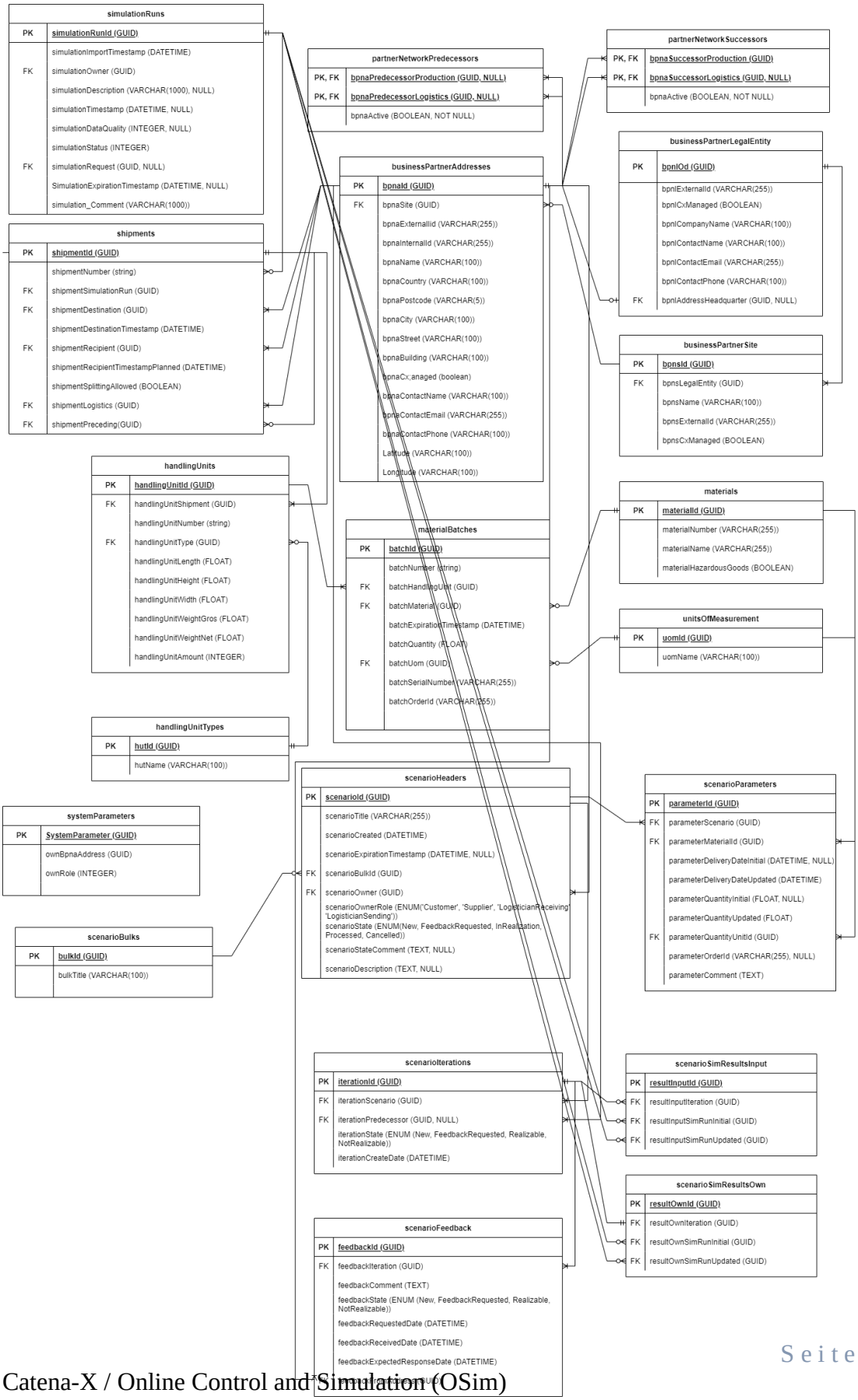
The following figure shows the overall architecture of the use case. The more detailed specification of the partner and simulation interfaces is described in the Interfaces chapter.



Data Model

A data model has been developed to store all simulation-relevant data of the OSim Manager. This data model contains all aspects that were specified in previous user stories as requirements for the OSim Manager itself and for the data model.

The following model describes the OSim Manager's internal data model, which is used to store data in the OSim Manager. For the exchange of data via external interfaces (REST APIs to simulation tools or EDC), corresponding data models are derived based on the data objects specified here.


simulationRuns
PK simulationRunId (GUID)
simulationImportTimestamp (DATETIME)
FK simulationOwner (GUID)
simulationDescription (VARCHAR(1000), NULL)
simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)
simulationStatus (INTEGER)
FK simulationRequest (GUID, NULL)
SimulationExpirationTimestamp (DATETIME, NULL)
simulation_Comment (VARCHAR(1000))
partnerNetworkPredecessors
PK, FK bpnaPredecessorProduction (GUID, NULL)
PK, FK bpnaPredecessorLogistics (GUID, NULL)
bpnaActive (BOOLEAN, NOT NULL)
partnerNetworkSuccessors
PK, FK bpnaSuccessorProduction (GUID)
PK, FK bpnaSuccessorLogistics (GUID, NULL)
bpnaActive (BOOLEAN, NOT NULL)
businessPartnerLegalEntity
PK bpnlOd (GUID)
bpnlExternalId (VARCHAR(255))
bpnlCxManaged (BOOLEAN)
bpnlCompanyName (VARCHAR(100))
bpnlContactName (VARCHAR(100))
bpnlContactEmail (VARCHAR(255))
bpnlContactPhone (VARCHAR(100))
FK bpnlAddressHeadquarter (GUID, NULL)
businessPartnerAddresses
PK bpnaId (GUID)
FK bpnaSite (GUID)
bpnaExternalId (VARCHAR(255))
bpnaInternalId (VARCHAR(255))
bpnaName (VARCHAR(100))
bpnaCountry (VARCHAR(100))
bpnaPostcode (VARCHAR(5))
bpnaCity (VARCHAR(100))
bpnaStreet (VARCHAR(100))
bpnaBuilding (VARCHAR(100))
bpnaCx;anaged (boolean)
bpnaContactName (VARCHAR(100))
bpnaContactEmail (VARCHAR(255))
bpnaContactPhone (VARCHAR(100))
Latitude (VARCHAR(100))
Longitude (VARCHAR(100))
businessPartnerSite
PK bpnsId (GUID)
FK bpnsLegalEntity (GUID)
bpnsName (VARCHAR(100))
bpnsExternalId (VARCHAR(255))
bpnsCxManaged (BOOLEAN)
shipments
PK shipmentId (GUID)
shipmentNumber (string)
FK shipmentSimulationRun (GUID)
FK shipmentDestination (GUID)
shipmentDestinationTimestamp (DATETIME)
FK shipmentRecipient (GUID)
shipmentRecipientTimestampPlanned (DATETIME)
shipmentSplittingAllowed (BOOLEAN)
FK shipmentLogistics (GUID)
FK shipmentPreceding(GUID)
handlingUnits
PK handlingUnitId (GUID)
FK handlingUnitShipment (GUID)
handlingUnitNumber (string)
FK handlingUnitType (GUID)
handlingUnitLength (FLOAT)
handlingUnitHeight (FLOAT)
handlingUnitWidth (FLOAT)
handlingUnitWeightGros (FLOAT)
handlingUnitWeightNet (FLOAT)
handlingUnitAmount (INTEGER)
materialBatches
PK batchId (GUID)
batchNumber (string)
FK batchHandlingUnit (GUID)
FK batchMaterial (GUID)
batchExpirationTimestamp (DATETIME)
batchQuantity (FLOAT)
FK batchUom (GUID)
batchSerialNumber (VARCHAR(255))
batchOrderId (VARCHAR(255))
materials
PK materialId (GUID)
materialNumber (VARCHAR(255))
materialName (VARCHAR(255))
materialHazardousGoods (BOOLEAN)
unitsOfMeasurement
PK uomId (GUID)
uomName (VARCHAR(100))
handlingUnitTypes
PK hutId (GUID)
hutName (VARCHAR(100))
systemParameters
PK SystemParameter (GUID)
ownBpnaAddress (GUID)
ownRole (INTEGER)
scenarioHeaders
PK scenarioId (GUID)
scenarioTitle (VARCHAR(255))
scenarioCreated (DATETIME)
scenarioExpirationTimestamp (DATETIME, NULL)
FK scenarioBulkId (GUID)
FK scenarioOwner (GUID)
scenarioOwnerRole (ENUM('Customer', 'Supplier', 'LogisticianReceiving' 'LogisticianSending'))
scenarioState (ENUM(New, FeedbackRequested, InRealization, Processed, Cancelled))
scenarioStateComment (TEXT, NULL)
scenarioDescription (TEXT, NULL)
scenarioParameters
PK parameterId (GUID)
FK parameterScenario (GUID)
FK parameterMaterialId (GUID)
parameterDeliveryDateInitial (DATETIME, NULL)
parameterDeliveryDateUpdated (DATETIME)
parameterQuantityInitial (FLOAT, NULL)
parameterQuantityUpdated (FLOAT)
FK parameterQuantityUnitId (GUID)
parameterOrderId (VARCHAR(255), NULL)
parameterComment (TEXT)
scenarioBulks
PK bulkId (GUID)
bulkTitle (VARCHAR(100))
scenarioIterations
PK iterationId (GUID)
FK iterationScenario (GUID)
FK iterationPredecessor (GUID, NULL)
iterationState (ENUM (New, FeedbackRequested, Realizable, NotRealizable))
iterationCreateDate (DATETIME)
scenarioSimResultsInput
PK resultInputId (GUID)
FK resultInputIteration (GUID)
FK resultInputSimRunInitial (GUID)
FK resultInputSimRunUpdated (GUID)
scenarioSimResultsOwn
PK resultOwnId (GUID)
FK resultOwnIteration (GUID)
FK resultOwnSimRunInitial (GUID)
FK resultOwnSimRunUpdated (GUID)
scenarioFeedback
PK feedbackId (GUID)
FK feedbackIteration (GUID)
feedbackComment (TEXT)
feedbackState (ENUM (New, FeedbackRequested, Realizable, NotRealizable))
feedbackRequestedDate (DATETIME)
feedbackReceivedDate (DATETIME)
feedbackExpectedResponseDate (DATETIME)

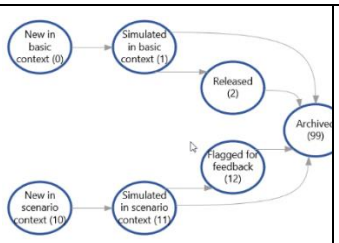
Detailed explanation

PK/ FK/ Unique	Attrribute	Can be Null ?	Description	Comment on Source of Data
	systemParameters		representation of system parameters in database	
	ownBpnaAddress (GUID)	not null	bpna_id of myself	
	ownRole (INTEGER)	null	Defines whether I have producer or logistics role. Legal entries are only 1 for producer or 2 for logistics or NULL	
	businessPartnerLegalEntity			
PK	bpnlId (GUID)	not null	Primary key of business partner legal entity (assigned by OSim Manager)	
Unique	bpnlExternalIid (VARCHAR(255))	not null	business partner network legal ID	IF business partner is partner in Catena, this is derived from Catena BPDM (Business Partner Data Management). If business partner is not in Catena, this ID must be aligned (manually, e.g. via chat functionality and subsequent manual management of partner network) with any of my partner who are also dealing with this business partner. Similarly, the "internal" partner adress ID used by the simulation tool (from e.g. ERP) must be entered manually by OSim operator
	bpnlCxManaged (BOOLEAN)	not null	is partner in Catena-X network	(locally managed by OSim Manager)
	bpnlCompanyName (VARCHAR(100))	not null	Company Name (imported from CX, or entered manually. If contradictory, CX information overrides manual info). E.g. "Siemens"	
	bpnlContactName (VARCHAR(100))	null	Name of contact person for e.g. chat, data exchange	
	bpnlContactEmail (VARCHAR(255))	null	email of contact person	
	bpnlContactPhone (VARCHAR(100))	null		

	bpnlAddressHeadquarter (GUID)	null	bpna_id of the many local adresses which serves as company headquarter	
	businessPartnerSite			
PK	bpnsId (GUID)	not null	Primary key of business partner site (assigned by OSim Manager)	
FK	bpnsLegalEntity (GUID)	not null	PK of parent legal entity (foreign key of database)	
Unique	bpnsExternalId (VARCHAR(255))	not null	BPNS ID	see comment of bpnl_external_id
	bpnsName (VARCHAR(100))	not null	Name of company site. E.g. "Siemens Amberg"	
	bpnsCxManaged (BOOLEAN)	not null	is partner in Catena-X network	managed manually within OSim Manager (but must be consisten across network)
	businessPartnerAddresses			
PK	bpnaId (GUID)	not null	Primary key of business partner address (assigned by OSim Manager)	local OSim manager
FK	bpnaSite (GUID)	not null	PK of parent site (foreign key of database)	local OSim manager
Unique	bpnaExternalId (VARCHAR(255))	not null	BPNA ID	see comment of bpnl_external_id
Unique	bpnaInternalId (VARCHAR(255))	null	business partner adress ID as known in my local simulation tool (e.g. from ERP system)	from local ERP system and identical to the one used in simulation tool, entered MANUALLY by OSim operator
	bpnaName (VARCHAR(100))	not null	Name of specific address within company site (e.g. "Siemens Amberg GWA")	
	bpnaCountry (VARCHAR(100))	not null	Address country (imported from CX, or entered manually. If contradictory, CX information overrides manual info)	
	bpnaPostcode (VARCHAR(5))	not null	Address postcode (imported from CX, or entered manually. If contradictory, CX information overrides manual info)	
	bpnaCity (VARCHAR(100))	not null	Address city (imported from CX, or entered manually. If contradictory, CX information overrides manual info)	

	bpnaStreet (VARCHAR(100))	not null	Address street (imported from CX, or entered manually. If contradictory, CX information overrides manual info)	
	bpnaBuilding (VARCHAR(100))	not null	Address Building (imported from CX, or entered manually. If contradictory, CX information overrides manual info)	
	bpnaCxManaged (boolean)	not null	Is partner in Catena-X network	
	bpnaContactName (VARCHAR(100))	null	Name of contact person for e.g. chat, data exchange	
	bpnaContactEmail (VARCHAR(255))	null	Email of contact person	
	bpnaContactPhone (VARCHAR(100))	null	Phone numeber of contact person / hotline	
	Latitude (VARCHAR(100))	null	Latitude of address in degrees, coded as string	
	Longitude (VARCHAR(100))	null	Longitude of address in degrees, coded as string	
	partnerNetworkSuccessors		this entity describes the successors of myself, stopping at the next producer (i.e. nobody can see beyond the next producer)	
PK, FK	bpnaSuccessorProduction (GUID)	not null	address of successor production	
PK, FK	bpnaSuccessorLogistics (GUID)	null	address of the next (i.e. first) successor logistics (located between myself and the successor_production)	
	bpnaActive (BOOLEAN)	not null	flag to control, whether this successor node will be shown in the network graph or not	
	partnerNetworkPredecessors		this entity describes the predecessors of myself, stopping at the predecessing producer (i.e. nobody can see beyond the previous producer)	
PK	bpnaPredecessorProduction (GUID)	null	address of predecessor production Can be NULL in case when two logistics in a row, the second logistics company shouldn't know who was the producer	

PK	bpnaPredecessorLogistics (GUID)	null	address of the last predecessor logistics (between predecessor_production and myself)	
	bpnaActive (BOOLEAN)	not null	flag to control, whether this predecessot node will be shown in the network graph or not	
	simulationRuns			
PK	simulationRunId (GUID)	not null	private key only used by the database	
FK	simulationOwner (GUID)	not null	BPNA ID of simulation originator	local ID assigned by my OSim manager
	simulationDescription (VARCHAR(1000))	null	Verbal description. Assigned by OSim manager originating the simulation	OSim manager originating the simulation
	simulationRunTimestamp (DATETIME)	null	Simulation Date and Time (in UTC (ISO8601)). written by simulation originator	simulation originator
	simulationDataQuality (INTEGER)	null	Information on quality of simulation results	simulation originator
	simulationStatus (INTEGER)	not null	Information on status of the simulation. Can be : 0 for simulation request, 1 for simulation executed but not released, 2 for simulation result released, 10 for simulation request in scenario context 11 for simulation executed in scenario context 12 for flagging a simulation result for scenario feedback request 99 for archived	set by OSim manager of simulation origin. **In Basic context (= standard simulation) :** Status 0 (request) indicates for the simulation tool to carry out this run. The status 99 (archived) will be set automatically, when a newer run from the same owner will be released (status=2). User can set own simulation of status 1 to status 2 by clicking on "Release simulation" on "Simulation detail page". When this is done: All older own simulations of status 1 and 2 will be set to 99. **In Scenario context:** Status 10 (request) indicates for the simulation tool to carry out this run.

				Status 11 (simulated) will be set by the simulation interface while importing the simulation results. Status 12 (selected) will be set by user during the analysis of the different simulation results. With this flags the user one simulation result for a feedback request. The status 99 (archived) will be set automatically for all not selected (Status <>12) simulation results, when the user triggers the feedback request for the one selected (Status =12) simulation result. The status 99 (archived) will be set automatically for all simulation results, when the scenario is canceled or closed.
	simulationImportTimestamp (DATETIME)		Simulation import Date and Time (in UTC (ISO8601)).	OSIM Manager
	SimulationExpirationTimestamp (DATETIME)	NULL	Date and Time when the simulation is expired	
	simulationComment (VARCHAR(1000))	NULL	additional comments (company internal)	Simulation tool
	shipments			
PK	shipmentId (GUID)	not null	private key only used by the database	
	shipmentNumber (VARCHAR(255))	not null	ID to identify the shipment	generated by simulator
FK	shipmentSimulation_run (GUID)	not null	ID of simulation to which the shipment belongs (foreign key)	
FK	shipmentDestination (GUID)	not null	Address where the shipment is immediately delivered to (by logistican) or provided for pickup (by producer). A BPNA number, received from OSim manager by simulation tool	simulator
	shipmentDestinationTimestamp (DATETIME)	null	Time (ISO8601) when delivery arrives / or is ready at goods issue	simulator (either production or logistics)
FK	shipmentRecipient (GUID)	not null	Address of final recipient of shipment. BPNA provides to simulation tool by OSim manager	Set by producer of the shipment content, only copied by subsequent simulators
	shipmentRecipientTimestampPlanned (DATETIME)	null	Planned delivery time (ISO8601): the latest due date	Set by production simulation, only copied by subsequent simulators

			when final reciepient should receive the order	
	shipmentSplittingAllowed (BOOLEAN)	not null	Permition to split the shipment into individual deliveries	Set by production simulation, only copied by subsequent simulators
FK	shipmentLogistics (GUID)	not null	Address of logistician (LSP) executing this shipment (logistician enters his own ID, producer enters ID of hte logistician taking over this shipment). Represented at BPNA, transformation to be discussed.	simulator
FK	shipmentPreceding (GUID)	null	Reference ID of the preceding shipment (to be written by logistics simulation)	logistics simulator
	handlingUnits		Handling unit is smallest shipment unit, cannot be divided into several shipments	
PK	handlingUnitId (GUID)	not null	private key only used by the database	
	handlingUnitNumber (VARCHAR(255))	not null	ID of the handling Unit, generated by originator	Set by producer of the shipment content, only copied by subsequent simulators
FK	handlingUnitShipment (GUID)	not null	Reference to the Shipment ID	Set by producer of the shipment content, only copied by subsequent simulators
FK	handlingUnitType (GUID)	null	Type of the Handling Unit, e.g. Box, Pallette,	ID set by OSim manger, content (e.g. "palette" written by simulation tool, only copied by subsequent simulators
	handlingUnitVolume (FLOAT)	null	Volume of the Handling Unit measured in m^3	Set by producer of the shipment content, only copied by subsequent simulators
	handlingUnitWeight (FLOAT)	null	Weight of the Handling Unit measured in kg	Set by producer of the shipment content, only copied by subsequent simulators
	handlingUnitAmount (INTEGER)	not null	Number of Handling Units with identical content	Set by producer of the shipment content, only copied by subsequent simulators
	materialBatches			
PK	batch_Id (GUIDI)	not null	private key only used by the database	
	batchNumber (VARCHAR(255)	not null	ID of the batch, generated by originator	Set by producer of the shipment content, only copied by subsequent simulators

FK	batchHandling_unit (GUID)	not null	reference to the handling unit containing the batch	
FK	batchMaterial (GUID)	not null	ID of the material contained in the batch	Set individually in each OSim Manager
	batchExpiration_timestamp (DATETIME)	null	Experiation date of batch (e.g. food items, liquids etc)	Set by producer of the shipment content, only copied by subsequent simulators
	batchQuantity (FLOAT)	not null	amount of materials a number of UOMs	Set by producer of the shipment content, only copied by subsequent simulators
FK	batchUom (GUID)	not null	unit of measurement of the quantity	Set by producer of the shipment content, only copied by subsequent simulators
	batchSerialNumber (VARCHAR(255)	null	actual batch number used by the production simulation. Can be used to uniquely identify a single product part. Is irrelevant for OSim functionality and can be empty.	Set by producer of the shipment content, only copied by subsequent simulators
	batchOrderId (VARCHAR(255))	not null	Order ID to which the batch belongs. Order ID is the Customer's order number!	Set by producer of the shipment content, only copied by subsequent simulators
	materials			
PK	materialId (GUID)	not null	local id for this material	Set individually in each OSim Manager
Unique	materialNumber (VARCHAR(255))	not null	id of this material (known between supplier and customer) Material number is the Customer's material number!	Set by producer of the shipment content, only copied by subsequent simulators
	materialName (VARCHAR(255))	not null	Name of material (can also be an article, product, etc.)	Set by producer of the shipment content, only copied by subsequent simulators
	materialHazardousGoods (BOOLEAN)	not null	flag whether material is hazardous	Set by producer of the shipment content, only copied by subsequent simulators
	unitsOfMeasurement			
PK	uomId (GUID)	not null	local id of UOM	Set individually in each OSim Manager
Unique	uomName (VARCHAR(100))	not null	unit of measurement	Set individually in each OSim Manager
	handlingUnitTypes			

PK	hutId (GUID)	not null	local id for handling unit type	Set individually in each OSim Manager
Unique	hutName (VARCHAR(100))	not null	Description of handling unit type (e.g. "palette")	Set individually in each OSim Manager
	scenarioHeaders		Every time when a request for a feedback is comming in and as long the scenario with the transmitted ID is not existing in the own DB, a scenario header has to be created	
PK	scenarioId (GUID)	not null	ID of scenario header (created by OSim Manager)	set by creator and not changeable
	scenarioTitle (VARCHAR(255))	not null	Title of scenario	set by creator and not changeable
	scenarioCreated (DATETIME)	not null	Date and Time of scanrio creation	set by creator and not changeable
	scenarioExpirationTimestamp (DATETIME)	not null	Date and Time of validity expiration	set by creator and not changeable
FK	scenarioBulkId (GUID)	null	Grouping scenarios together to a bulk (FK to table scenarioBulks)	set at creation and not changeable and not transmitted
FK	scenarioOwner (GUID)	not null	owner of the simulation scenario (BPNA)	set by creator and not changeable
	scenarioOwnerRole(ENUM('Customer', 'Supplier', 'LogisticianReceiving', 'LogisticianSending'))	not null	role of scenario owner	set by creator and not changeable
	scenarioState (ENUM)	not null	current state of scenario header. For values definition see state machine definition here: General description	current own status (can be different at each partner)
	scenarioStateComment (TEXT)	null	Possibility for the owner of the scenario to add comment to the current state.	Will be used while synchronizing the state of the scenario with the partners after feedback round. E.g. setting state to "In realization". With this it will be possible to indicate the measure of the owner and a recommendation to the partners
	scenarioDescription (TEXT)	null	description of scenario	set by creator and not changeable
	scenarioBulks			
PK	bulkId (GUID)	not null	ID of the bulk	
	bulkTitle (VARCHAR 100)	not null	Title/name of the bulk	
	scenarioParameters			

PK	parameterId (GUID)	not null	ID of scenario Parameter	
FK	parameterScenario (GUID)	not null	foreign key to scenario header	multiple parameters can be assigned to one scenario header (1:n connection)
FK	parameterMaterialId (GUID)	not null	foreign key to material	
	parameterDeliveryDateInitial (DATETIME)	null	delivery date initial (without scenario changes), optional, NULL when initially not set	
	parameterDeliveryDateUpdated (DATETIME)	not null	delivery date updated (with scenario changes)	
	parameterQuantityInitial (FLOAT)	null	amount initial (without scenario changes), optional, NULL when initially not set	
	parameterQuantityUpdated (FLOAT)	not null	amount updated (with scenario changes)	
FK	parameterQuantityUnitId (GUID)	not null	foreign key to unit of measurement for the quantity	
	parameterOrderId (VARCHAR(255))	null	order id	
	parameterComment (TEXT)	null	optional description of parameters	
	scenarioIterations		Every time when a request for a feedback is comming in, a scenario iteration record has to be created. Because a request for feedback can arrive a node twice, this iteration will need to be linkt to the already existing scenario.	
PK	iterationId (GUID)	not null	ID of scenario iteration	
FK	iterationScenario (GUID)	not null	foreign key to scenario header	
FK	iterationPredecessor (GUID)	null	GUID of direct requesting Supply chain partner.	Initiator of the scenario fills this field with NULL, This field is used to send the **own** decision made to the requestor
	iterationState (ENUM)	not null	current state of scenario feedback. For values definition see state machine definition here: Introduction into Scenario Management	
	iterationCreateDate (DATETIME)	not null	Date and Time of scanrio iteration creation	
	scenarioSimResultsInput		This is the incomming simulation result of the feedback requestor	

PK	resultInputId (GUID)	not null	ID of scenario result input	
FK	resultInputIteration (GUID)	not null	foreign key to scenarioIteration.iterationId	
FK	resultInputSimRunInitial (GUID)	null	foreign key to simulation result based on initial parameters	
FK	resultInputSimRunUpdated (GUID)	null	foreign key to simulation result based on updated parameter (scenario)	
	scenarioSimResultsOwn		This is the own generated simulation result	
PK	resultOwnId (GUID)	not null	ID of scenario result own	
FK	resultOwnIteration (GUID)	not null	foreign key to scenarioIteration.iterationId	
FK	resultOwnSimRunInitial (GUID)	null	foreign key to simulation result based on initial parameters	
FK	resultOwnSimRunUpdated (GUID)	null	foreign key to simulation result based on updated parameter (scenario)	
	scenarioFeedback			this record is only kept in the feedback requestor's database
PK	feedbackId (GUID)	not null	ID of the feedback request	
FK	feedbackIteration (GUID)	not null	foreign key to scenarioIteration.iterationId	
	feedbackComment (TEXT)	null	free comment	set by feedback requestor
	feedbackState (ENUM)	not null	current state of scenario feedback. For values definition see state machine definition here: Introduction into Scenario Management	
	feedbackRequestedDate (DATETIME)	not null	date, when the feedback request was sent out	
	feedbackReceivedDate (DATETIME)	null	date, when the feedback came in	is at the beginning null, and will be filled after receiveing a feedback from the partner
	feedbackExpectedResponseDate (DATETIME)	not null	expiration date of the feedback request.	set by feedback requestor In case no feedback will arrive at this time, the scenario can be canceled/ignored
FK	feedbackFromAddress (GUID)	not null	reference to the BPNA of the partner, whos feedback is	

			requested (= destination of the request)	

Gathering and entering of data

This chapter describes for specific cases how the data required by the data model is acquired and entered into the data base.

Identification of partners: Mapping between internal and external partner IDs

The data model of the OSim manager supports external and internal partner IDs in order to uniquely identify the partners in the supplier customer network for all participating stakeholders (Catena partners, simulation tools, OSim manager).

The external partner IDs are by default (see next section for exceptions) the IDs assigned by Catena-X (BPN, business partner network).

The internal partner IDs are identical to the IDs used by the local simulation tool (which typically uses the IDs of the local ERP system).

For this reason, the entity "business partner adresses" contains two attributes ("bpna_external_id" und "bpna_internal_id") to enable a mapping.

The attribute "bpna_internal_id" is entered manuelly by the (human) OSim operator, who knows the ID used by the local simulation tool and enters exactly this ID here.

Handling and assignment of the external partner IDs of OSim partners which do not use Catena-X

If OSim business partner uses Catena, the external partner ID ("bpnl_external_id", "bpns_external_id", "bpna_external_id") is derived from Catena BPDM (Business Partner Data Management).
If OSim business partner does not use Catena and thus is not known in the Catena BPDM, this ID must be generated locally in OSim manager and aligned (manually, e.g. via chat functionality and subsequent manual management of partner network) with any of my partners who are also dealing with this business partner.

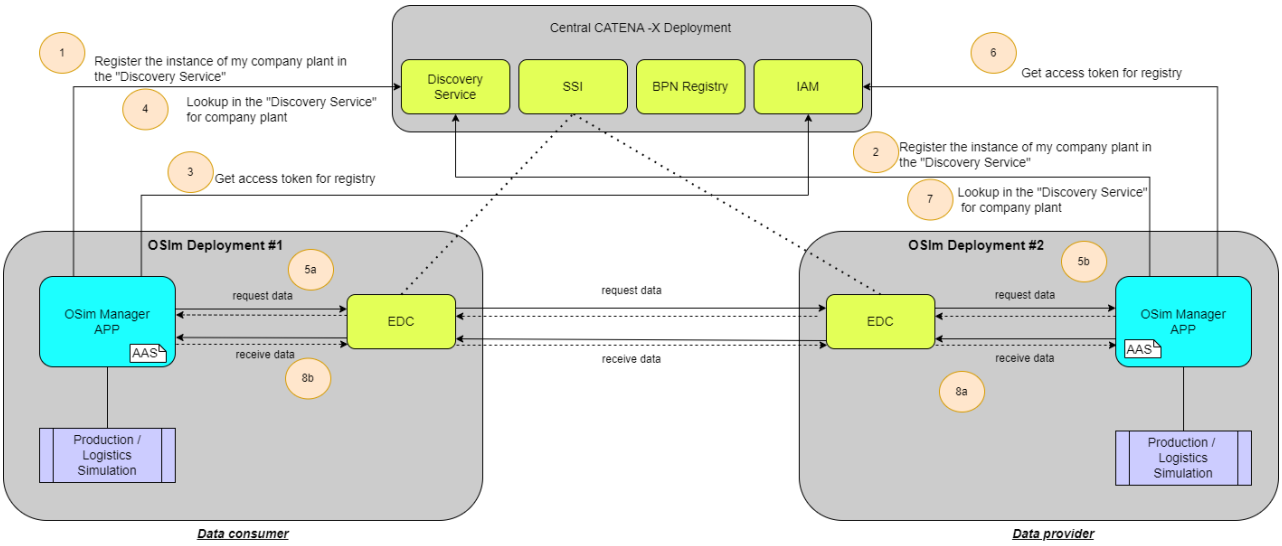
Identifying materials

Material numbers across different partners are likely different in their internal (e.g. ERP) systems. We assume for the time being that this mapping is solved in the local ERP systems. I.e. our attribute "material_name" for a given material is uniquely used in our partner network.

Interfaces

Partner Interface: OSim Manager and OSim Manager

The Eclipse Data Connector (EDC) interface enables data exchange between the OSim managers of the participating partners. This Catena-X standardised approach ensures that data security, sovereignty and interoperability are guaranteed. For this purpose, various central services of the CATENA platform are always integrated in advance of a data exchange.



Technical requirements for a CATENA-X compliant data transmission

Use of the following central services is a prerequisite for CATENA-X compliant data transmission

- BPN Registry = Management of Business Partner Leagal Entities, Sites and Addresses used to identify the Partners and their BPN-IDs for communication
- IAM = IdP used to login against Catena-X services (esp. needed for Digital Twin Registry)
- SSI = Central service hosting the EDCs certificates (public keys). Used for mutual authentication between different EDC instances

- DS = Discovery Service as a central registry used to store/lookup the EDC endpoints for OSim requests/sending.
- EDC = Handling contract negotiation and initiates data transfer.

For this, appropriate configurations must be made in advance.

1. In the BPN registry, all partner instances (production sites) participating in the OSim use case must be listed with their respective site identification and address. The BPN IDs of the production sites (=BPNS) are used for registration in the DS.
2. In the IAM, each OSim participating partner must apply for a "technical user", which is used for process communication with the central services.
3. Registration of OSim endpoints takes place in the Discovery Service.
4. The certificates required for ISS are issued on request.

At runtime, each command more or less always runs through the same instances:

1. The OSim Manager application must know the partner BPN-ID of the communication partner.
2. With this BPN-ID, a look-up command is issued on the Discovery Service. The result is the endpoint link that the EDC connector needs to establish the connection.

The following sequence diagram shows the basic procedure for setting up the EDC connection:

Partner Interface for basic flow

The "Partner Interface for basic flow" enables the exchange of simulation results between two OSim Manager instances.

In terms of content, it enables the following information to be exchanged:

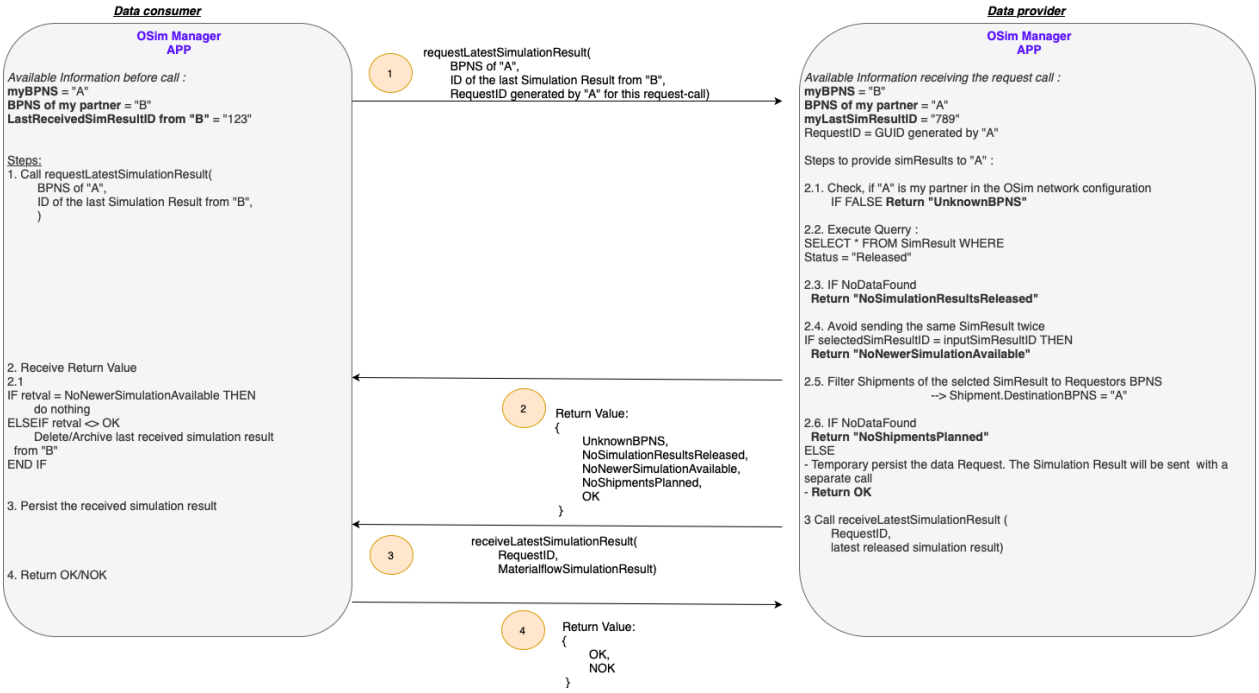
- Request for a simulation result = requestLatestSimulationResult() is a request from a direct OSim partner (only supply-chain ascending!) for the last simulation result to be included in the caller's simulation run

- Feedback of own simulation result = receiveLatestSilationResult(MaterialflowSimulationReslt) enables the data supplier to transfer the simulation result tailored to the caller

The following diagram shows the basic call sequence. This is an asynchronous process in which the data consumer makes a request in the first step.

- the data consumer makes a request to receive the last simulation result. The parameters are
    - BPNS address of the data consumer
    - ID of the last simulation result registered with the data consumer
    - RequestID as a companion for the asynchronous mechanism. This enables the data consumer to ensure that the data actually comes from the requested partner.
- The data provider accepts the request and carries out the following preliminary clarifications:
    - Is the transferred BPNS a partner in the network configuration of the data provider?
    - Can a simulation result be shared (i.e. is it in "Released" status)?
    - Has the current simulation result already been exchanged with the data consumer?
    - If data for the data consumer is available in the simulation result
- The data provider gives the corresponding feedback to the data consumer about the result of its preliminary clarification

In the second step, the data provider sends back the information relevant for the data consumer (simulation results) as a payload by calling the receiveLatestSilationResult function. The response is sent via the EDC endpoint that belongs to the BPNS received as a parameter. The RequestId of the requestor is also returned.



*Function **requestLatestSimulationResult()***

The *requestLatestSimulationResult* data MUST be sent from the consumer of simulation results to the provider of simulation results using an HTTP GET request. The endpoint of the API MUST handle the BPNS of the requesting OSim partner, the requestId and MUST have the simulationRunID of the last received simulation result as a path parameter in the URL. In case the simulationRunID is unknown, "0" is to be used as default.

Input parameter

Parameter	Description	Way of parameter transfer
BPNS	is mandatory and must to be filled with the BPNS ID of the requestor.	URL parameter
simulationRunID	is optional and may be filled by requestor with the ID of the last received simulation result. Otherwise, "0" value must be sent.	URL parameter
RequestID	is mandatory and must to be filled with a GUID. This Parameter will be used in the receiveLatestSimulationResult call.	URL parameter

Functional Reponse

Rest API Code	Status Message	Description
200	OK	The request has succeeded. The requestLatestSimulationResult has been successfully processed in the backend system.
400	Bad request	The server cannot or will not process the request due to something that is perceived to be a client error (e.g., malformed request syntax, invalid request message framing, or deceptive request routing).
401	Unauthorized	Although the HTTP standard specifies "unauthorized", semantically this response means "unauthenticated". That is, the client must authenticate itself to get the requested response.
402	Unknown BPNS	The BPNS which is given as parameter is not registered in the data provider database as a direct partner.
403	Forbidden	The client does not have access rights to the content; that is, it is unauthorized, so the server is refusing to give the requested resource.
404	No simulation results are released	Data provider doesn’t have any **released** simulation results
405	Method not allowed	The method used to request the data was not POST
406	No newer simulation available	The simulationRunID which is given as parameter is identical to the currently released simulation run in the data provider database
407	No shipments planned	No shipments are currently planned for the requestor
500	Internal Server Error	The server has encountered a situation it does not know how to handle.
503	Service Unavailable	The server is not ready to handle the request.

Function receiveLatestSimulationResult()

The *receiveLatestSimulationResult* endpoint MUST be implemented by all participants who participate in the Catena-X OSim network supporting the HTTP POST request method.

The endpoint MUST implement a parameter requestId transmitted by the URL which is used to correlate the sent simulation result to the previously sent request as well as to validate if the sent simulation result is being returned from the receiver of the request. The parameter requestId MUST contain the value of the requestId which has been sent with *requestLatestSimulationResult* Funktion.

Input parameter

Parameter	Description	Way of parameter transfer
RequestID	Is mandatory and must to be the same as received with the questLatestSimulationResult call. Note: This parameter allows to ensure, that the data consumer is recveving data from the requested data producer and not elsewhere.	URL parameter
LatestSimulationResult	See the payload description below.	Payload

Parameter mapping

Source DB-Attribute	Transformation to payload	Payload	Transformation to target DB-Attributes	Target DB-Attribute
simulationRuns	---->>>>>>------	**simulationRuns**	---->>>>>>------	**simulationRuns**
simulationRunId (GUID)	set value	simulationRunId (GUID)	set value	simulationRunId (GUID)
simulationOwner (GUID)	transform Osim-internal GUID into bpnsExternalId	simulationOwner (VARCHAR)	transform bpnsExternalId into Osim-internal GUID	simulationOwner (GUID)
simulationDescription (VARCHAR(1000))	set value	simulationDescription (VARCHAR(1000))	set value	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME, NULL)	set value	simulationTimestamp (DATETIME)	set value	simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
simulationStatus (INTEGER)	-	-	Basic flow → set value 2 Sceario related flow → set value 12	simulationStatus (INTEGER)

simulationImportTimestamp (DATETIME)	-	-	Simulation import Date and Time (in UTC (ISO8601)).	simulationImportTimestamp (DATETIME)
simulationExpirationTimestamp (DATETIME)	set value	simulationExpirationTimestamp (DATETIME)	set value	simulationExpirationTimestamp (DATETIME)
simulationComment (VARCHAR(1000))	-	-	NULL	simulationComment (VARCHAR(1000))
shipments	---->>>>>>------	**shipments**	---->>>>>>------	**shipments**
shipmentId (GUID)	set value	shipmentId (GUID)	set value	shipmentId (GUID)
shipmentSimulationRun (GUID)	consider shipments below simulationRuns in the JSON hierarchy	-	reference known implicitly by JSON hierarchy	shipmentSimulationRun (GUID)
shipmentDestination (GUID)	transform Osim-internal GUID into bpnsExternalId	shipmentDestination (VARCHAR(255))	transform bpnsExternalId into Osim-internal GUID	shipmentDestination (GUID)
shipmentDestinationTimestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)
shipmentRecipient (GUID)	transform Osim-internal GUID into bpnsExternalId	shipmentRecipient (VARCHAR(255))	transform bpnsExternalId into Osim-internal GUID	shipmentRecipient (GUID)
shipmentRecipientTimestampPlanned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)
shipmentSplittingAllowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)
shipmentLogistics (GUID)	transform Osim-internal GUID into bpnsExternalId	shipmentLogistics (VARCHAR(255))	transform bpnsExternalId into Osim-internal GUID	shipmentLogistics (GUID)
shipmentPreceding (GUID)	set value	shipmentPreceding (GUID)	set value	shipmentPreceding (GUID)
handlingUnits	---->>>>>>------	**handlingUnits**	---->>>>>>------	**handlingUnits**
handlingUnitId (GUID)	set value	handlingUnitId (GUID)	set value	handlingUnitId (GUID)
handlingUnitShipment (GUID)	consider handlingUnits below shipments in the JSON hierarchy	-	reference known implicitly by JSON hierarchy	handlingUnitShipment (GUID)

handlingUnitType (GUID)	transform Osim handling_unit_type to hut_name (using table handling_unit_types)	hutName (VARCHAR(100))	transform hutName to handlingUnitType using table handlingUnitTypes, if necessary, creating a new entry there	handlingUnitType (GUID)
handlingUnitVolume (DECIMAL)	set value	handlingUnitVolume (DECIMAL)	set value	handlingUnitVolume (DECIMAL)
handlingUnitWeight (DECIMAL)	set value	handlingUnitWeight (DECIMAL)	set value	handlingUnitWeight (DECIMAL)
handlingUnitAmount (INTEGER)	set value	handlingUnitAmount (INTEGER)	set value	handlingUnitAmount (INTEGER)
materialBatches	**---->>>>>>------**	**materialBatches**	**---->>>>>>------**	**materialBatches**
batchId (GUID)	set value	batchId (GUID)	set value	batchId (GUID)
batchHandlingUnit (GUID)	consider materialBatches below handlingUnits in the JSON hierarchy		reference known implicitly by JSON hierarchy	batchHandlingUnit (GUID)
batchMaterial (GUID)	transform batchMaterial to materialNumber using table materials	materialNumber (VARCHAR(255))	transform materialNumber to batchMaterial using table materials, if necessary, creating a new entry there	batchMaterial (GUID)
	transform batchMaterial to materialName using table materials	materialName (VARCHAR(255))	only verify if consistent with mapping above and if applicable add to new entry in table materials	-
	transform batchMaterial to materialHazardousGoods using table materials	materialHazardousGoods (BOOLEAN)	only verify if consistent with mapping above and if applicable add to new entry in table materials	-
batchExpirationTimestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)
batchQuantity (DECIMAL)	set value	batchQuantity (DECIMAL)	set value	batchQuantity (DECIMAL)

batchUom (GUID)	transform batchUom to batchUom using table "unitsOfMeasurement"	batchUom (VARCHAR(100))	transform batchUom to batchUom using table "unitsOfMeasurement", if necessary creating a new entry there	batchUom (GUID)
batchNumber (VARCHAR(100)	set value	batchNumber (VARCHAR(100)	set value	batchNumber (VARCHAR(100)
batchOrderId (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))

Return values

Rest API Code	Status Message	Description
200	OK	The POST has succeeded. The receiveLatestSimulationResult has been successfully processed in the backend system.
400	Bad request	The server cannot or will not process the request due to something that is perceived to be a client error (e.g., malformed request syntax, invalid request message framing, or deceptive request routing).
401	Authorized	Although the HTTP standard specifies "unauthorized", semantically this response means "unauthenticated". That is, the client must authenticate itself to get the requested response.
402	Payload is empty	The payload of the API call is empty.
403	Forbidden	The client does not have access rights to the content; that is, it is unauthorized, so the server is refusing to give the requested resource.
404	Payload structure unknown	The payload structure is unknown or correspond not to the defined semantic model.
405	Method not allowed	The method used to request the data was not POST.
406	Payload content invalid	The content of the payload is invalid. E.g. “owner unknown”.
500	Internal Server Error	The server has encountered a situation it does not know how to handle.
503	Service Unavailable	The server is not ready to handle the request.

Rest API specification (JSON)

Exemplary JSON object for receiveLatestSilationResult() Function


```
{
  "materialFlowSimulationResult": {
    "owner": {
      "bpns": "BPNS00000007OTZ3"
    },
    "dataQuality": 0,
    "description": "Please simulate asap",
    "comment": "successful simulation ",
    "expirationTimestamp": "2023-03-24T09:15:24.000Z",
    "runId": "0fece48b-c8d1-4180-1a9caca6d67e",
    "shipments": [
      {
        "handlingUnits": [
          {
            "name": "Palette",
            "volume": 1,
            "weight": 189,
            "batches": [
              {
                "unitOfMeasurement": "KG",
                "materialName": "KK1000GR-Gehäuse-Rot",
                "quantity": 50,
                "materialNumber": "KK1000GR",
                "materialHazardousGoods": false,
                "batchSerialNumber": "Batch_1",
                "batchOrderId": "Order-0001",
                "batchExpirationTimestamp": "2023-08-22T16:00:00.000Z",
                "batchNumber": "45"
              }
            ],
            "handlingUnitId": "HUT_1",
            "amount": 1
          }
        ],
        "shipmentId": "DE51515151",
        "recipientTimestampPlanned": "2023-04-19T09:00:00.000Z",
        "destination": {
          "bpns": "BPNS00000007OTZ3"
        },
        "recipient": {
          "bpns": "BPNS00000007OTZ3"
        },
        "logistics": {
          "bpns": "BPNS00000007OTZ3"
        },
        "preceding": {
          "bpns": "BPNS00000007OTZ3"
        },
```

```
      "splittingAllowed": true,
      "destinationTimestamp": "2023-03-19T09:00:00.000Z"
     }
    ],
    "timestamp": "2023-03-09T14:13:42.806Z"
  }
}
```

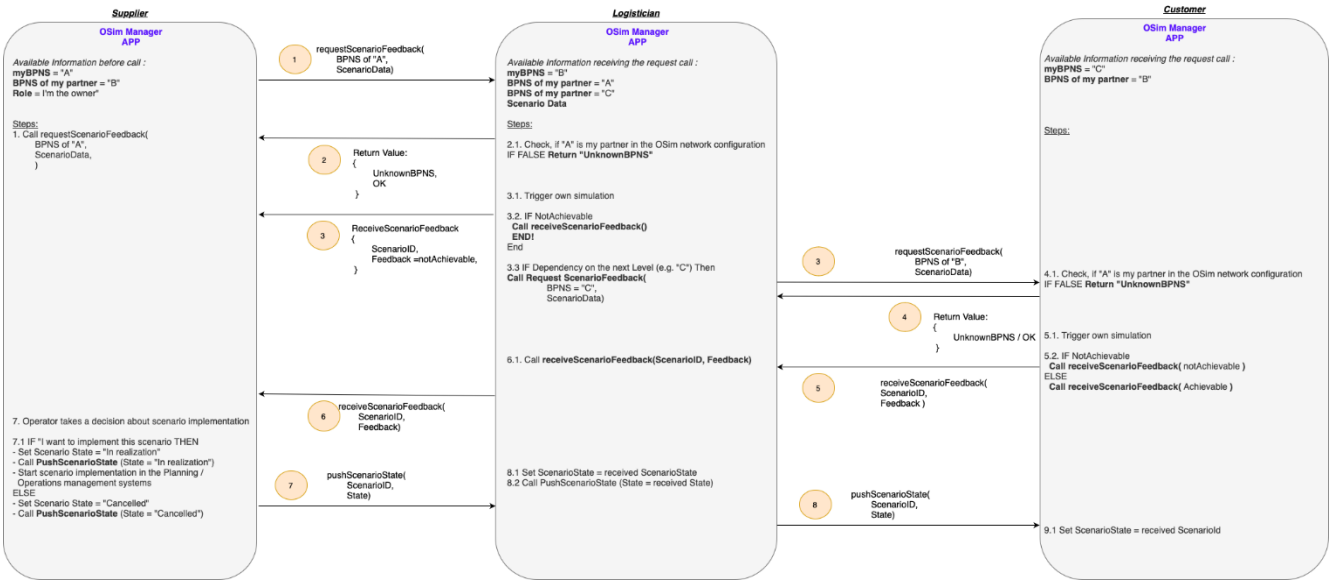

Partner Interface for szenario flow

The "Partner Interface for scenario management" enables the exchange of scenario requests and the resulting simulation results between two OSim Manager instances. In addition, the interface enables the exchange of commands for the synchronisation of the scenario statuses.

In terms of content, it offers the possibility to exchange the following information:

- Request for feedback on a scenario → **requestScenarioFeedback()** → is a request from a direct OSim partner (can go in both directions in the supply chain, depending on the scenario role) for feedback on the possible fulfilment of the described scenario. For more on the evaluation process at the requested party, see chapter Introduction into Scenario Management.
- Feedback → **receiveScenarioFeedback()** → enables the requestor to transmit the result of his scenario-based evaluation to the requestor.
- Send a scenario state → **pushScenarioState()** → enables distribution of a new scenario status and thus a notification of the procedure with the planned scenario.

The following sketch represents the principle call sequence using the example "Supplier is the Scenario Owner". The other data flows are described in the chapter Data flows , but the procedure is identical.



Function requestScenarioFeedback()

The requestScenarioFeedback data MUST be sent from the requestor of a feedback to the provider of a scenario feedback using an HTTP POST request.

The endpoint of the API MUST handle the BPNS of the requesting OSim partner transmitted by the URL.

Input parameter

Parameter	Description	Way of parameter transfer
BPNS (VARCHAR)	is mandatory and must to be filled with the BPNS ID of the requestor.	URL parameter
ScenarioData	See the payload description below.	Payload

Procedure at the caller side

The caller of the function proceeds as follows when preparing the parameters:

- Fill the parameter BPNS with the own BPNS_ID. This attribute is currently necessary in order to recognise on the other side where the request comes from.
- Filling the payload with the data of the scenario for which feedback is requested. The following information is transferred:

- In the **scenarioHeader** section, the scenario header information is to be transferred according to the parameter description.
  Attention! The field scenarioDescription should only be filled if there is no own simulation result with reference to the current scenario and the current iteration. Otherwise fill with NULL!

- The **scenarioParameters** section is hierarchically subordinate to the header. Several parameter sets can be transferred.
  Attention! This section should only be included in the payload if there is no simulation result with reference to the current scenario and the current iteration.

- The section **scenarioSimResultsOwn** is hierarchically subordinate to the header in the payload.
  Attention! If there is no entry in the entity scenarioSimResultsOwn for the current iteration, the scenarioParameters and the scenarioDescription must be transferred. (→ Mutual exclusion)
  There can be no or at most only 1 set of the own simulation results.

- The sections **resultOwnSimRunInitial** as well as **resultOwnSimRunUpdated** are each hierarchically subordinate to scenarioSimResultsOwn.
  The underlying structure here corresponds to the complete payload of the receiveLatestSilationResult() function.

Procedure at the receiver side

The data receiver stores the information as follows:

- The section **scenarioHeader** is recorded as a new entry in the entity scenarioHeaders.
  - Check before whether the header for the scenario does not yet exist.

- The section **scenarioParameters**, if filled, are stored in the entity scenarioParameters.

- An entry is created in **scenarioIteration**.
  Special values:
  - iterationPredecessor = internal ID of the feedback requestor from parameter BPNS converted to the internal OSim ID.
  - iterationState = New
  - iterationCreateDate = current date

- The **scenarioSimResultsOwn** section, if filled, are stored in the entity **scenarioSimResultsInput** with the reference to the previously created **scenarioIteration**.

- The sections **resultOwnSimRunInitial** and **resultOwnSimRunUpdated** lead to entries in the entities **simulationRun, shipments, handlingUnits, materialBatches**, analogous to the basic course and are subsequently linked to the entry in **scenarioSimResultsInput**.

Payload:

Source DB-Attribute	Transformation	Parameters in API	Transformation to target DB	Target DB-Attribute
scenarioHeaders	---->>>>>>------	**scenarioHeaders**	---->>>>>>------	**scenarioHeaders**
scenarioId	set value	scenarioId (GUID)	set value	scenarioId
scenarioTitle	set value	scenarioTitle (VARCHAR(255))	set value	scenarioTitle
scenarioCreated	set value	scenarioCreated (DATETIME)	set value	scenarioCreated
scenarioExpirationTimestamp	set value	scenarioExpirationTimestamp (DATETIME)	set value	scenarioExpirationTimestamp
scenarioBulkId	-	n/a	-	scenarioBulkId
scenarioOwner	transform Osim-internal GUID into bpnsExternalId	scenarioOwner (VARCHAR(255))	transform bpnsExternalId into Osim-internal GUID	scenarioOwner
scenarioOwnerRole	set value	scenarioOwnerRole (VARCHAR(50)	set value	scenarioOwnerRole
scenarioState	-	n/a	set value to "New"	scenarioState
scenarioStateComment	-	n/a	-	scenarioStateComment
scenarioDescription	This field to be filled, when no own simulation results are available! In other cases NULL to be sent. See more in the "Process on the caller side" below.	scenarioDescription (TEXT)	set value	scenarioDescription
scenarioParameters (optional)	---->>>>>>------	**scenarioParameters (optional)**	---->>>>>>------	**scenarioParameters (optional)**
parameterId	set value	parameterId (GUID)	set value	parameterId
parameterScenario	consider scenarioParameters below scenarioHeaders in the JSON hierarchy	n/a	reference known implicitly by JSON hierarchy	parameterScenario
parameterMaterialId	transform parameterMaterialId to materialNumber using table materials	materialNumber (VARCHAR(255))	transform materialNumber to parameterMateriaID using table materials, if necessary, creating a new entry there	parameterMaterialId

-	transform parameterMaterialId to materialName using table materials	materialName (VARCHAR(255))	only verify if consistent with mapping above and if applicable add to new entry in table materials	-
-	transform parameterMaterialId to materialHazardousGoods using table materials	materialHazardousGoods (BOOLEAN)	only verify if consistent with mapping above and if applicable add to new entry in table materials	-
parameterDeliveryDateInitial	set value	deliveryDateInitial (DATETIME)	set value	parameterDeliveryDateInitial
parameterDeliveryDateUpdated	set value	deliveryDateUpdated (DATETIME)	set value	parameterDeliveryDateUpdated
parameterQuantityInitial	set value	quantityInitial (FLOAT)	set value	parameterQuantityInitial
parameterQuantityUpdated	set value	quantityUpdated (FLOAT)	set value	parameterQuantityUpdated
parameterQuantityUnitId	transform parameterQuantityUnitId to quantityUom using table "unitsOfMeasurement"	quantityUom (VARCHAR(100))	transform quantityUom to parameterQuantityUnitId using table "unitsOfMeasurement"	batchUom (VARCHAR(100))
parameterOrderId	set value	orderId (VARCHAR(255))	set value	parameterOrderId
parameterComment	set value	comment (TEXT)	set value	parameterComment
scenarioSimResultsOwn (optional)	---->>>>>>------	**scenarioSimResults (optional)**	---->>>>>>------	**scenarioSimResultsInput (optional)**
resultOwnId (GUID)		resultOwnId (GUID)		resultOwnId (GUID)
resultOwnIteration (GUID)	consider scenarioSimResultsOwn below scenarioHeaders in the JSON hierarchy	n/a	reference to scenario is known implicitly by JSON hierarchy	resultOwnIteration (GUID)
resultOwnSimRunInitial	the complete structure of the payload of receiveLatestSilationResult() is to be transferred	see the payload definition here	the complete structure of the payload of receiveLatestSilationResult() is to be transferred	**resultInputSimRunInitial**
resultOwnSimRunUpdated	the complete structure of the payload of receiveLatestSilationResult() is to be transferred	see the payload definition here	the complete structure of the payload of receiveLatestSilationResult() is to be transferred	**resultInputSimRunUpdated**

Return values

Rest API Code	Status Message	Description
200	OK	The request has succeeded. The requestScenarioFeedback has been successfully processed in the backend system.
400	Bad request	The server cannot or will not process the request due to something that is perceived to be a client error (e.g., malformed request syntax, invalid request message framing, or deceptive request routing).
401	Unauthorized	Although the HTTP standard specifies "unauthorized", semantically this response means "unauthenticated". That is, the client must authenticate itself to get the requested response.
402	Unknown BPNS	The BPNS which is given as parameter is not registered in the data provider database as a direct partner.
403	Forbidden	The client does not have access rights to the content; that is, it is unauthorized, so the server is refusing to give the requested resource.
405	Method not allowed	The method used to request the data was not POST
500	Internal Server Error	The server has encountered a situation it does not know how to handle.
503	Service Unavailable	The server is not ready to handle the request.

Function receiveScenarioFeedback()

The *receiveScenarioFeedback* data MUST be sent from the provider of scenario feedback to the receiver of scenario feedback using an HTTP GET call.

The endpoint of the API MUST handle the BPNS of the requesting OSim partner, the scenario ID and the feedback value as a path parameter in the URL.

Input parameter

Parameter	Description	Way of parameter transfer
BPNS (VARCHAR)	Is mandatory and must to be filled with the BPNS ID of the feedback provider.	URL parameter
ScenarioId (VARCHAR)	Reference to the scenario	URL parameter
Feedback (VARCHAR)	The Values correspond with the ENUM feedbackState.	URL parameter

Procedure at the caller side

The caller of the function proceeds as follows when preparing the parameters:

- Fill the parameter BPNS with the own BPNS_ID. This attribute is currently necessary in order to recognise on the other side where the request comes from. In future versions of the EDC, this parameter will become superfluous and will be transmitted directly by the interface as meta-information.
- ScenarioId is to be filled with the ID of the scenario for which feedback is currently being provided.
- Feedback is the result of the feedbacks. The value corresponds to one of the feedback statuses taken as one.

Procedure at the receiver side

The feedback receiver proceeds as follows:

- Validate values for the parameter Feedback: allowed are "Realizable" or "NotRealizable"
- Determine the feedback corresponding to the passed scenarioId and BPNS feedback in the entity scenarioFeedback.
- Set the feedbackState attribute to the passed value.

Return values

Rest API Code	Status Message	Description
200	OK	The POST has succeeded. The receiveScenarioFeedback has been successfully processed in the backend system.
400	Bad request	The server cannot or will not process the request due to something that is perceived to be a client error (e.g., malformed request syntax, invalid request message framing, or deceptive request routing).
401	Authorized	Although the HTTP standard specifies "unauthorized", semantically this response means "unauthenticated". That is, the client must authenticate itself to get the requested response.
402	Unknown BPNS	The BPNS which is given as parameter is not registered in the data provider database as a direct partner.
403	Forbidden	The client does not have access rights to the content; that is, it is unauthorized, so the server is refusing to give the requested resource.
405	Method not allowed	The method used to request the data was not POST.
406	Unknown Scenario	The scenarioID which is given as parameter is not registered.
407	Unknown State	The feedbackState value is unknown.

500	Internal Server Error	The server has encountered a situation it does not know how to handle.
503	Service Unavailable	The server is not ready to handle the request.

Function pushScenarioState()

The *pushScenarioStat* data MUST be sent from the provider of scenario state to the receiver of scenario state using an HTTP POST call.

The endpoint of the API MUST handle the BPNS of the requesting OSim partner, the scenario ID and the state value as a path parameter in the URL. Additionally the payload includes a comment as a free text.

Input parameter

Parameter	Description	Way of parameter transfer
BPNS (VARCHAR)	Is mandatory and must to be filled with the BPNS ID of the feedback provider	URL parameter
ScenarioId (VARCHAR)	Reference to the scenario	URL parameter
State (VARCHAR)	The Values correspond with the ENUM scenarioState	URL parameter
Comment (VARCHAR)	Additional information to the state of scenario. Can be empty	Payload (VARCHAR as RAW)

Procedure at the caller side

The caller of the function proceeds as follows when preparing the parameters:

- Fill the parameter BPNS with the own BPNS_ID. This attribute is currently necessary in order to recognise on the other side where the request comes from. In future versions of the EDC, this parameter will become superfluous and will be transmitted directly by the interface as meta-information.
- ScenarioId is to be filled with the ID of the scenario for which feedback is currently being provided.
- State is the new scenario status after the confirmation process. The value corresponds to one of the values from ScenarioStatus-Enum
- Comment is additional information on the scenario status and is particularly important for the status "In Realisation".

Procedure at the receiver side

The feedback receiver proceeds as follows:

- Determine the scenario corresponding to the passed scenarioId.
- Set the scenarioState attribute to the value passed in the State parameter.
- Set the scenarioStateComment to the passed value in parameter Comment, if a NULL was not passed.
  Otherwise no change in scenarioStateComment.

Return values

Rest API Code	Status Message	Description
200	OK	The POST has succeeded. The pushScenarioState has been successfully processed in the backend system.
400	Bad request	The server cannot or will not process the request due to something that is perceived to be a client error (e.g., malformed request syntax, invalid request message framing, or deceptive request routing).
401	Authorized	Although the HTTP standard specifies "unauthorized", semantically this response means "unauthenticated". That is, the client must authenticate itself to get the requested response.
402	Unknown BPNS	The BPNS which is given as parameter is not registered in the data provider database as a direct partner.
403	Forbidden	The client does not have access rights to the content; that is, it is unauthorized, so the server is refusing to give the requested resource.
405	Method not allowed	The method used to request the data was not POST.
406	Unknown Scenario	The scenarioID which is given as parameter is not registered.
407	Unknown State	The scenarioState value is unknown.
500	Internal Server Error	The server has encountered a situation it does not know how to handle.
503	Service Unavailable	The server is not ready to handle the request.

Rest API specification (JSON)

Exemplary JSON object for requestScenarioFeedback() Function

```
{
  "materialFlowScenarioRequest": {
    "scenarioSimResults": {
      "resultOwnId": "916b5688-8bd8-4d7e-83b9-e0d40939274e",
```

```
"resultOwnSimRunInitial": {
 "owner": {
  "bpns": "BPNS00000007OTZ3"
 },
 "dataQuality": 0,
 "description": "Please simulate asap",
 "comment": "successful simulation ",
 "expirationTimestamp": "2023-03-24T09:15:24.000Z",
 "runId": "0fece48b-c8d1-4180-1a9caca6d67e",
 "shipments": [
  {
   "handlingUnits": [
    {
     "name": "Palette",
     "volume": 1,
     "weight": 189,
     "batches": [
      {
       "unitOfMeasurement": "KG",
       "materialName": "KK1000GR-Gehäuse-Rot",
       "quantity": 50,
       "materialNumber": "KK1000GR",
       "materialHazardousGoods": false,
       "batchSerialNumber": "Batch_1",
       "batchOrderId": "Order-0001",
       "batchExpirationTimestamp": "2023-08-22T16:00:00.000Z",
       "batchNumber": "45"
      }
     ],
     "handlingUnitId": "HUT_1",
     "amount": 1
    }
   ],
   "shipmentId": "DE51515151",
   "recipientTimestampPlanned": "2023-04-19T09:00:00.000Z",
   "destination": {
    "bpns": "BPNS00000007OTZ3"
   },
   "recipient": {
    "bpns": "BPNS00000007OTZ3"
   },
   "logistics": {
    "bpns": "BPNS00000007OTZ3"
   },
   "preceding": {
    "bpns": "BPNS00000007OTZ3"
   },
   "splittingAllowed": true,
   "destinationTimestamp": "2023-03-19T09:00:00.000Z"
  }
 ],
```

```
  "timestamp": "2023-03-09T14:13:42.806Z"
 },
 "resultOwnSimRunUpdated": {
  "owner": {
   "bpns": "BPNS00000007OTZ3"
  },
  "dataQuality": 0,
  "description": "Please simulate asap",
  "comment": "successful simulation ",
  "expirationTimestamp": "2023-03-24T09:15:24.000Z",
  "runId": "0fece48b-c8d1-4180-1a9caca6d67e",
  "shipments": [
   {
    "handlingUnits": [
     {
      "name": "Palette",
      "volume": 1,
      "weight": 189,
      "batches": [
       {
        "unitOfMeasurement": "KG",
        "materialName": "KK1000GR-Gehäuse-Rot",
        "quantity": 50,
        "materialNumber": "KK1000GR",
        "materialHazardousGoods": false,
        "batchSerialNumber": "Batch_1",
        "batchOrderId": "Order-0001",
        "batchExpirationTimestamp": "2023-08-22T16:00:00.000Z",
        "batchNumber": "45"
       }
      ],
      "handlingUnitId": "HUT_1",
      "amount": 1
     }
    ],
    "shipmentId": "DE51515151",
    "recipientTimestampPlanned": "2023-04-19T09:00:00.000Z",
    "destination": {
     "bpns": "BPNS00000007OTZ3"
    },
    "recipient": {
     "bpns": "BPNS00000007OTZ3"
    },
    "logistics": {
     "bpns": "BPNS00000007OTZ3"
    },
    "preceding": {
     "bpns": "BPNS00000007OTZ3"
    },
    "splittingAllowed": true,
    "destinationTimestamp": "2023-03-19T09:00:00.000Z"
```

```
      }
     ],
     "timestamp": "2023-03-09T14:13:42.806Z"
    }
   },
   "scenarioParameter": [
    {
     "unitOfMeasurement": "KG",
     "parameterComment": "updated Delivery Date",
     "materialName": "KK1000GR-Gehäuse-Rot",
     "parameterQuantityUpdated": 1,
     "parameterId": "847c71e5-614a-468b-a3a0-674bf2af3004",
     "materialNumber": "KK1000GR",
     "parameterDeliveryDateUpdated": "2023-10-10T09:00:00.000Z",
     "parameterDeliveryDateInitial": "2023-10-09T10:00:00.000Z",
     "parameterOrderId": "OID-011123546",
     "parameterQuantityInitial": 1
    }
   ],
   "scenarioHeader": {
    "scenarioOwnerRole": "Customer",
    "scenarioCreationTimestamp": "2023-10-04T09:10:00.000Z",
    "scenarioExpirationTimestamp": "2023-10-07T09:10:00.000Z",
    "scenarioOwner": {
     "bpns": "BPNS00000007OTZ3"
    },
    "scenarioDescription": "Changes in Delivery Date",
    "scenarioId": "8d464b8b-6977-4952-8a22-0489067ca081",
    "scenarioTitle": "Delivery Modification"
   }
  }
}
```


Simulation Interface: Simulationstools and OSim Manager

The "Simulation Interface" is available for data exchange between the simulation tools and the OSim Manager.

A distinction is made between the "Basic Flow" and the "Scenario Flow".

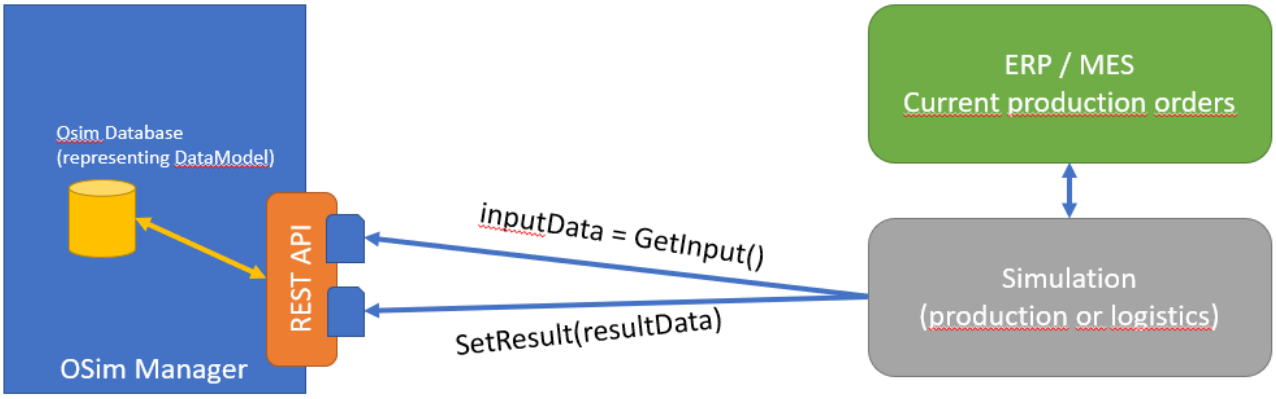
- "Basic Flow" fulfils the purpose of a basic simulation and provides simulation results based on the current information of the own plant and the imported simulation results of the predecessors in the OSim network.
- "Scenario Flow" fulfils the purpose of simulations that have to be carried out based on a scenario.

Simulation Interface for basic flow

The simulation interface provides the interface to exchange data between the simulation tools and the OSim manager.

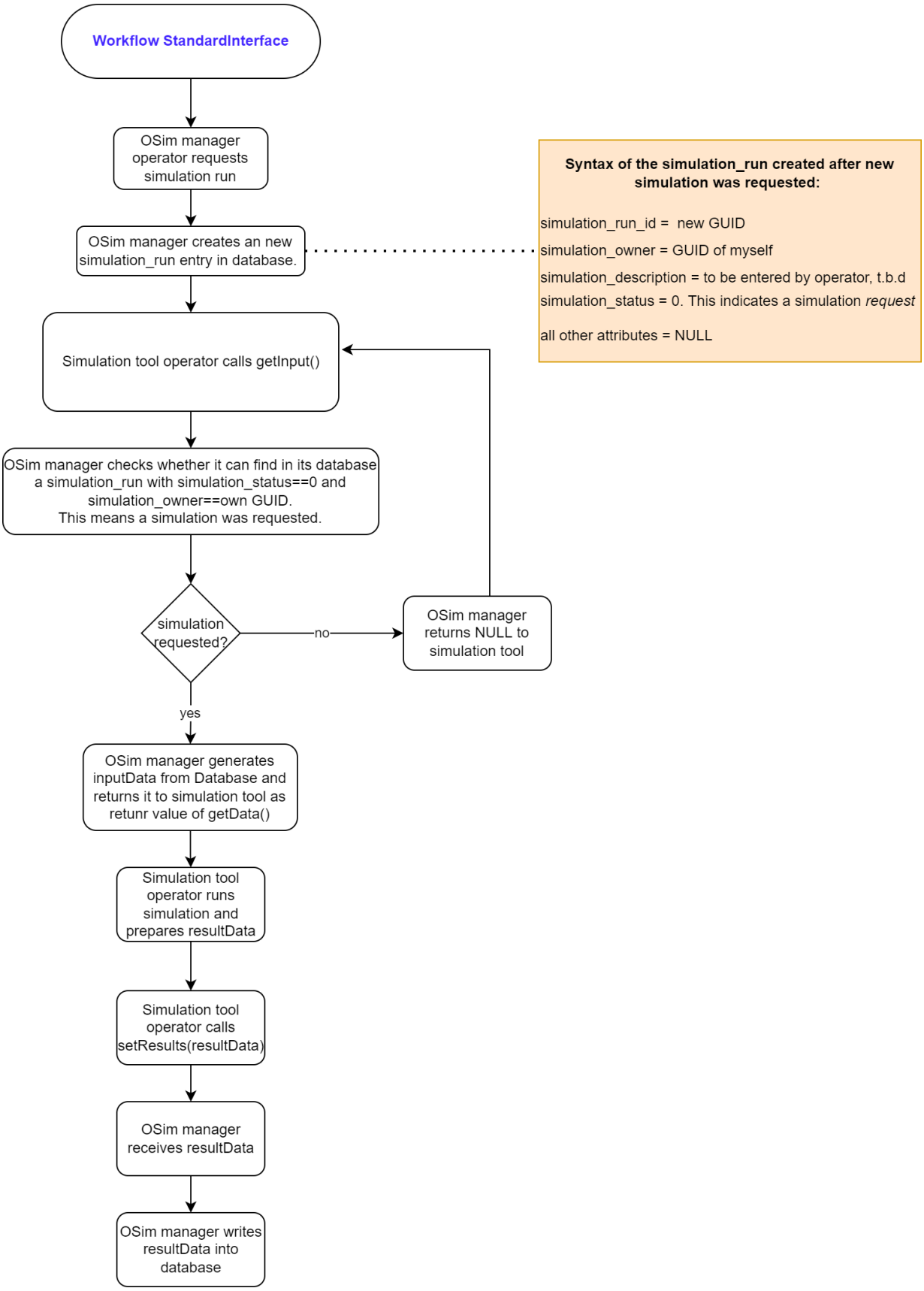
It offers two functions which both have to be called by the simulation tool:

- inputdata = getInput() provides to the simulation tool the most up-to-date data on which to base a new simulation. If the OSim manager does not currently request a simulation, this function returns NULL.
- setResult (resultData) allows the simulation tool to return the results of its simulation to the OSim manager



Workflow

The following sketches the flow of actions which happen when the standard interface is used


Workflow StandardInterface
OSim manager operator requests simulation run
OSim manager creates an new simulation_run entry in database.
Syntax of the simulation_run created after new simulation was requested:
simulation_run_id = new GUID
simulation_owner = GUID of myself
simulation_description = to be entered by operator, t.b.d
simulation_status = 0. This indicates a simulation request
all other attributes = NULL
Simulation tool operator calls getInput()
OSim manager checks whether it can find in its database a simulation_run with simulation_status==0 and simulation_owner==own GUID.
This means a simulation was requested.
simulation requested?
no
OSim manager returns NULL to simulation tool
yes
OSim manager generates inputData from Database and returns it to simulation tool as retunr value of getData()
Simulation tool operator runs simulation and prepares resultData
Simulation tool operator calls setResults(resultData)
OSim manager receives resultData
OSim manager writes resultData into database

Function GetInput()

GetInput() returns NULL if the OSim Manager does not currently have a simulation request (see Workflow for details).

It returns the data as defined below if a simulation request is present in the database.

The third column of the table (Simulation Input to API) describes the data that will be handed over to the simulation tool. The first two columns describe how this data is acquired from the OSim database.

Return Values

Function	Rest API Code	Description
SetResult	201	indicates successful handover, and maybe we will hand back the ID of the simulation
SetResult	400	is an error, indicates you used the wrong format
SetResult	500	is an error, indicates the OSim database does not know some of the entities (e.g. addresses) you are referring to
GetInput	200	indicates successful handover
GetInput	400	is an error, indicates you used the wrong format

Parameter mapping

DB-Attribute	Transformation	Simulation Input in API
simulationRuns (containing own_request)	**---->>>>>>------**	**simulationRunsOwnRequest**
simulationExternalId (GUID)	set value	simulationExternalId (GUID)
simulationOwner (GUID)	set value	simulationOwner (GUID)
simulationDescription (VARCHAR(1000))	set value	simulationDescription (VARCHAR(1000))
other fields	ignore	

simulationRuns	**Osim: Create empty bpna_id_list. Go over all partner_network_predecessors. IF (bpna_predecessor_logistics!=NULL) add bpna_predecessor_logistics to bpna_id_list ELSE add bpna_predecessor_production to bpna_id_list. Select all simulation_runs with status = 2 and simulation_owner in bpna_id_list**	**simulationRuns**
simulationExternalId (GUID)	set value	simulationId (GUID)
simulationOwner (GUID)	transform Osim-internal GUID into internal ID (ERP)	simulationOwner
simulationDescription (VARCHAR(1000))	set value	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME, NULL)	set value	simulationTimestamp (DATETIME, NULL)
simulationData_quality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
simulationStatus (INTEGER)	set value	simulationStatus (INTEGER)
shipments	**---->>>>>>------**	**shipments**
shipmentExternalId (GUID)	set value	shipmentId (GUID)
shipmentSimulationRun (GUID)	reference known implicitly by JSON hierarchy	
shipmentDestination (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentDestination (GUID)
shipmentDestinationTimestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)
shipmentRecipient (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentRecipient (GUID)
shipmentRecipientTimestampPlanned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)
shipmentSplittingAllowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)
shipmentLogistics (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentLogistics (GUID)
shipmentPreceding	set value	shipmentPreceding
handlingUnits	**---->>>>>>------**	**handlingUnits**
handlingUnitExternalId (GUID)	set value	handlingUnitId (GUID)

handlingUnitShipment (GUID)	reference known implicitly by JSON hierarchy	
handlingUnitType (GUID)	transform Osim handling_unit_type to hut_name (using table handling_unit_types)	hutName (VARCHAR(100))
handlingUnitVolume (DECIMAL)	set value	handlingUnitVolume (DECIMAL)
handlingUnitWeight (DECIMAL)	set value	handlingUnitWeight (DECIMAL)
handlingUnitAmount (INTEGER)	set value	handlingUnitAmount (INTEGER)
materialBatches	**---->>>>>>------**	**materialBatches**
batchExternalId (GUID)	set value	batchId (GUID)
batchNumber	set value	batchNumber
batchHandlingUnit (GUID)	reference known implicitly by JSON hierarchy	
batchMaterial (GUID)	transform Osim batch_material GUID to the three material properties (using table materials)	materialNumber (VARCHAR(255))
	transform Osim batch_material GUID to the three material properties (using table materials)	materialName (VARCHAR(255))
	transform Osim batch_material GUID to the three material properties (using table materials)	materialHazardousGoods (BOOLEAN)
batchExpirationTimestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)
batchQuantity (DECIMAL)	set value	batchQuantity (DECIMAL)
batchUom (GUID)	transform Osim batch_uom GUID to actual name of batch_uom (using table "units of measurement")	batchUom (VARCHAR(100))
batchSerialNumber (VARCHAR(100)	set value	batchSerialNumber (VARCHAR(100)
batchOrderId (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))

Function SetResult(resultData)

The simulation tool calls the SetResult Function with a JSON file containing the resultData as specified in the first column of below table (Simulation output in API). The 2nd and 3rd columns describe how this is transformed into entries in the OSim DB.

Parameter mapping

Simulation output in API	Transformation	Target DB-Attribute
simulationRuns	---->>>>>>------	**simulationRuns**
simulationRunId (GUID)	use for identifying the correct record (of my own requested simulatio run)	simulationRunId (GUID)
	do not change	simulationOwner (GUID)
	do not change	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME)	set value	simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
	set to 1	simulationStatus (INTEGER)
shipments	---->>>>>>------	**shipments**
shipmentId (GUID)	set value	shipmentId (GUID)
	reference known implicitly by JSON hierarchy	shipmentSimulationRun (GUID)
shipmentDestination (VARCHAR(255))	transform internal ID (ERP)into internal GUID (Osim)	shipmentDestination (GUID)
shipmentDestinationTimestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)
shipmentRecipient (VARCHAR(255))	transform internal ID (ERP)into internal GUID (Osim)	shipmentRecipient (GUID)
shipmentRecipientTimestampPlanned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)
shipmentSplittingAllowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)
shipmentLogistics (VARCHAR(255))	transform internal ID (ERP)into internal GUID (Osim)	shipmentLogistics (GUID)
shipmentPreceding (NULL only for production simulation)	set value	shipmentPreceding
handlingUnits	---->>>>>>------	**handlingUnits**
handlingUnitId (GUID)	set value	handlingUnitId (GUID)
	reference known implicitly by JSON hierarchy	handlingUnitShipment (GUID)
hutName (VARCHAR(100))	transform hut_name to Osim handling_unit_type (using table handling_unit_types, if necessary, creating a new entry there)	handlingUnitType (GUID)
handlingUnitVolume (DECIMAL)	set value	handlingUnitVolume (DECIMAL)

handlingUnitWeight (DECIMAL)	set value	handlingUnitWeight (DECIMAL)
handlingUnitAmount (INTEGER)	set value	handlingUnitAmount (INTEGER)
materialBatches	**---->>>>>>------**	**materialBatches**
batchId (GUID)	set value	batchId (GUID)
batchNumber	set value	batchNumber
	reference known implicitly by JSON hierarchy	batchHandlingUnit (GUID)
materialNumber (VARCHAR(255))	transform material_number to Osim batch_material (using table materials (here local attribute is called material_id), if necessary, creating a new entry there)	batchMaterial (GUID)
materialName (VARCHAR(255))	only verify if consistent with mapping above and if applicable add to new entry in table materials	
materialHazardousGoods (BOOLEAN)	only verify if consistent with mapping above and if applicable add to new entry in table materials	
batchExpirationTimestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)
batchQuantity (DECIMAL)	set value	batchQuantity (DECIMAL)
batchUom (VARCHAR(100))	transform explicit name batch_uom to Osim GUID batch_uom (using table "units of measurement" (here local attribute is called uom_id), if necessary, creating a new entry there)	batchUom (GUID)
batchSerialNumber (VARCHAR(100)	set value	batchSerialNumber (VARCHAR(100)
batchOrderId (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))

Rest API specification (JSON)

Exemplary JSON object for GetInput() Function

```
{
  "simulationRunId": "string",
  "simulationOwner": "string",
  "simulationDescription": "string",
  "simulationRuns": [
    {
      "simulationRunId": "string",
```

```
    "simulationOwner": "string",
    "simulationDescription": "string",
    "simulationTimestamp": "2022-08-12T08:05:58.188Z",
    "simulationDataQuality": 0,
    "simulationStatus": 0,
    "shipments": [
     {
       "shipmentId": "string",
       "shipmentDestination": "string",
       "shipmentDestinationTimestamp": "2022-08-12T08:05:58.188Z",
       "shipmentRecipient": "string",
       "shipmentRecipientTimestampPlanned": "2022-08-12T08:05:58.188Z",
       "shipmentSplittingAllowed": true,
       "shipmentLogistics": "string",
       "shipmentPreceding": "string",
       "handlingUnits": [
        {
          "handlingUnitId": "string",
          "hutName": "string",
          "handlingUnitVolume": 0.123,
          "handlingUnitWeight": 0.123,
          "handlingUnitAmount": 0,
          "materialBatches": [
           {
            "batchId": "string",
            "batchNumber": "string",
            "materialNumber": "string",
            "materialName": "string",
            "materialHazardousGoods": true,
            "batchExpirationTimestamp": "2022-08-12T08:05:58.188Z",
            "batchQuantity": 0.123,
            "batchUom": "string",
            "batchSerialNumber": "string",
            "batchOrderId": "string"
           }

         ]
        }
       ]
     }
    ]
   }
 ]
}
```

Exemplary JSON object for SetResult() Function

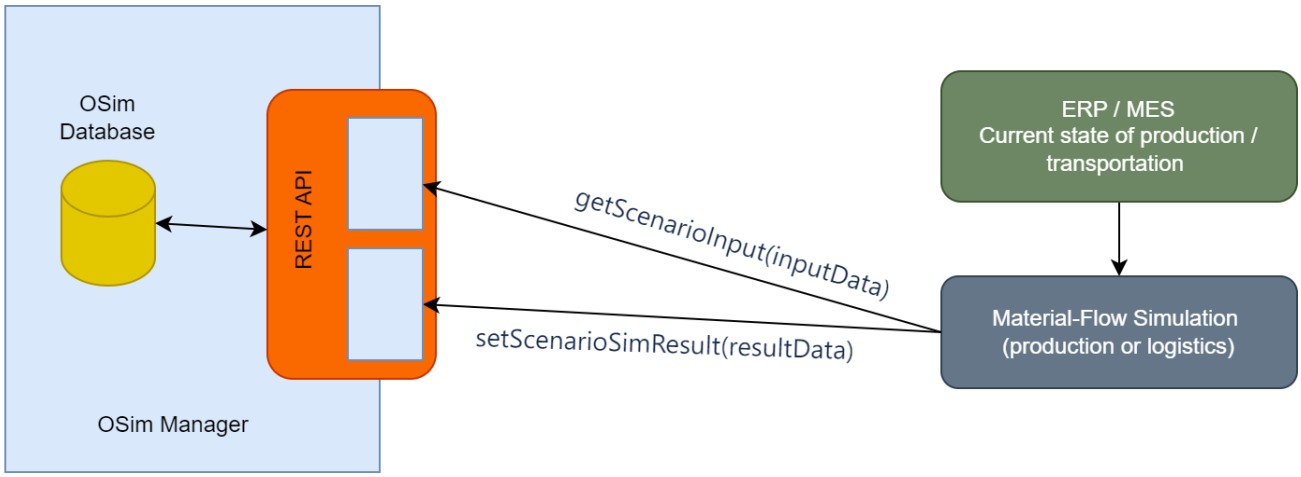

```
{
   "simulationRunId": "string",
   "simulationTimestamp": "2022-08-12T08:30:00.478Z",
   "simulationDataQuality": 0,
   "shipments": [
    {
     "shipmentId": "string",
     "shipmentDestination": "string",
     "shipmentDestinationTimestamp": "2022-08-12T08:30:00.478Z",
     "shipmentRecipient": "string",
     "shipmentRecipientTimestampPlanned": "2022-08-12T08:30:00.478Z",
     "shipmentSplittingAllowed": true,
     "shipmentLogistics": "string",
     "shipmentPreceding": "string",
     "handlingUnits": [
      {
       "handlingUnitId": "string",
       "hutName": "string",
       "handlingUnitVolume": 0.123,
       "handlingUnitWeight": 0.123,
       "handlingUnitAmount": 0,
       "materialBatches": [
        {
         "batchId": "string",
         "batchNumber": "string",
         "materialNumber": "string",
         "materialName": "string",
         "materialHazardousGoods": true,
         "batchExpirationTimestamp": "2022-08-12T08:30:00.478Z",
         "batchQuantity": 0.123,
         "batchUom": "string",
         "batchSerialNumber": "string",
         "batchOrderId": "string"
        }
       ]
      }
     ]
    }
   ]
 }
```


Simulation Interface for szenario flow

The "Simulation Interface for scenario flow" is available for data exchange between the simulation tools and the OSim Manager.

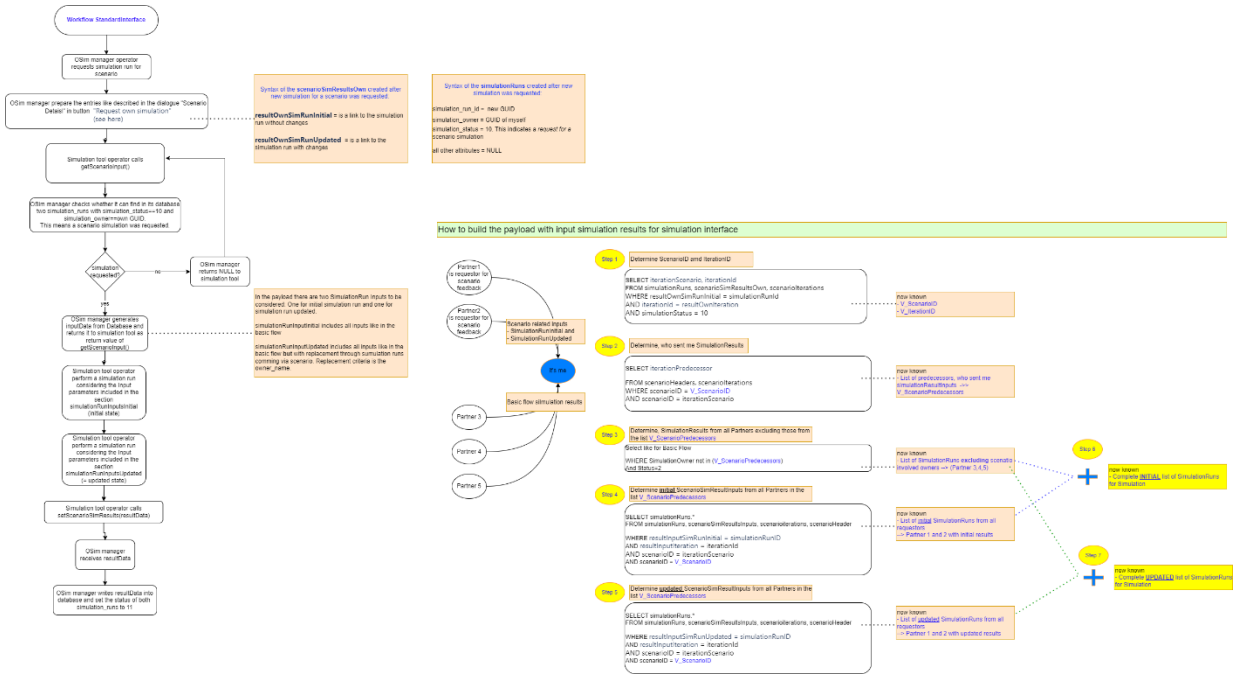
It provides two functions, both of which have to be called by the simulation tool:

- inputdata = getScenarioInput(inputData) provides the simulation tool with the scenario parameters as well as simulation results of the predecessors if available, on which the new simulation can be based. If the OSim manager does not currently request a simulation for a scenario, this function returns NULL.
- setScenarioSimResult (resultData) allows the simulation tool to return the results of its simulation to the OSim manager



Workflow

The following sketches the flow of actions which happen when the standard interface is used



Function getScenarioInput(inputData)

getScenarioInput(inputData) returns NULL if the OSim manager currently has no simulation request (see workflow for details).

If there is a simulation request for a scenario in the database, the data will be returned as defined below.

The third column of the table (Simulation Input to API) describes the data that is passed to the simulation tool. The first two columns describe how this data is obtained from the OSim database.

Return values

Function	Rest API Code	Description
setScenarioSimResult	201	indicates successful handover, and maybe we will hand back the ID of the simulation
setScenarioSimResult	400	is an error, indicates you used the wrong format
setScenarioSimResult	500	is an error, indicates the OSim database does not know some of the entities (e.g. addresses) you are referring to
getScenarioInput	200	indicates successful handover
getScenarioInput	400	is an error, indicates you used the wrong format

Parameter mapping

DB-Attribute	Transformation	Simulation Input in API
simulationRunInitial (containing own_request for the initial simulation run, status = 10)	**---->>>>>>------**	**simulationRunsOwnRequestInitial**
simulationRunId (GUID)	set value	simulationRunId (GUID)
simulationOwner (GUID)	set value	simulationOwner (GUID)
simulationRunUpdated (containing own_request for the updated simulation run, status = 10)	**---->>>>>>------**	**simulationRunsOwnRequestUpdated**
simulationRunId (GUID)	set value	simulationRunId (GUID)
simulationOwner (GUID)	set value	simulationOwner (GUID)
scenarioHeader		

scenarioId	set value	scenarioId (GUID)
scenarioTitle	set value	scenarioTitle (VARCHAR 255)
scenarioDescription	set value	scenarioDescription (TEXT)
scenarioParameters (can be Empty)		
parameterId	set value	parameterId (GUID)
parameterScenario (GUID)	set value	parameterScenario (GUID)
parameterMaterialId (GUID)	set value	parameterMaterialId (GUID)
parameterDeliveryDateInitial (DATETIME)	set value	parameterDeliveryDateInitial (DATETIME)
parameterDeliveryDateUpdated (DATETIME)	set value	parameterDeliveryDateUpdated (DATETIME)
parameterQuantityInitial (FLOAT)	set value	parameterQuantityInitial (FLOAT)
parameterQuantityUpdated (FLOAT)	set value	parameterQuantityUpdated (FLOAT)
parameterQuantityUnitId (GUID)	set value	parameterQuantityUnitId (GUID)
parameterOrderId (VARCHAR(255))	set value	parameterOrderId (VARCHAR(255))
parameterComment (TEXT)	set value	parameterComment (TEXT)
simulationRunInputsInitial	**See the description above in the workflow called "How to build the payload ....". Step 6 depicts the result**	**simulation_run_inputs**
simulationExternalID (GUID)	set value	simulationId (GUID)
simulationOwner (GUID)	transform Osim-internal GUID into internal ID (ERP)	simulationOwner
simulationDescription (VARCHAR(1000))	set value	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME, NULL)	set value	simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)	set value	simulationData_quality (INTEGER, NULL)
simulationStatus (INTEGER)	set value	simulationStatus (INTEGER)
shipments	**---->>>>>>------**	**shipments**
shipmentExternalId (GUID)	set value	shipmentId (GUID)
shipmentSimulationRun (GUID)	reference known implicitly by JSON hierarchy	
shipmentDestination (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentDestination (GUID)
shipmentDestinationTimestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)

shipmentRecipient (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentRecipient (GUID)
shipmentRecipientTimestampPlanned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)
shipmentSplittingAllowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)
shipmentLogistics (GUID)	transform Osim-internal GUID into internal ID (ERP)	shipmentLogistics (GUID)
shipmentPreceding	set value	shipmentPreceding
handlingUnits	**---->>>>>>------**	**handlingUnits**
handlingUnitExternalId (GUID)	set value	handlingUnitId (GUID)
handlingUnitShipment (GUID)	reference known implicitly by JSON hierarchy	
handlingUnitType (GUID)	transform Osim handling_unit_type to hut_name (using table handling_unit_types)	hutName (VARCHAR(100))
handlingUnitVolume (DECIMAL)	set value	handlingUnitVolume (DECIMAL)
handlingUnitWeight (DECIMAL)	set value	handlingUnitWeight (DECIMAL)
handlingUnitAmount (INTEGER)	set value	handlingUnitAmount (INTEGER)
materialBatches	**---->>>>>>------**	**materialBatches**
batchExternalId (GUID)	set value	batchId (GUID)
batchHandlingUnit (GUID)	reference known implicitly by JSON hierarchy	
batchMaterial (GUID)	transform Osim batch_material GUID to the three material properties (using table materials)	materialNumber (VARCHAR(255))
	transform Osim batch_material GUID to the three material properties (using table materials)	materialName (VARCHAR(255))
	transform Osim batch_material GUID to the three material properties (using table materials)	materialHazardousGoods (BOOLEAN)
batchExpirationTimestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)
batchQuantity (DECIMAL)	set value	batchQuantity (DECIMAL)
batchUom (GUID)	transform Osim batch_uom GUID to actual name of batch_uom (using table "units of measurement")	batchUom (VARCHAR(100))

batchNumber (VARCHAR(100)	set value	batchNumber (VARCHAR(100)
batchIrderId (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))
simulationRunInputsUpdated	**See the description above in the workflow called "How to build the payload ....". Step 7 depicts the result** **The structure in the payload is equivalent to simulationRunInputsInitial.**	**simulation_run_inputs**

Function SetScenarioSimResult(resultData)

The simulation tool calls the SetScenarioSimResult function with a JSON file containing the resultData as specified in the first column of the table below (simulation output in API). The 2nd and 3rd columns describe how this data is converted into entries in the OSim-DB.

Parameter mapping

Simulation output in API	Transformation	Target DB-Attribute
simulationRunsOwnRequestInitial	**---->>>>>>------**	**simulationRuns**
simulationRunId (GUID)	use for identifying the correct record in the OSim DB (of my own requested simulatio run)	simulationRunId (GUID)
	do not change	simulationOwner (GUID)
	do not change	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME)	set value	simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
	set to 11 (Simulation executed)	simulationStatus (INTEGER)
For all entities related to the simulation result "Initial" (shipments, handling_units, material_batches) use the description of the API function setResult()		
simulationRunsOwnRequestUpdated	**---->>>>>>------**	**simulationRuns**

simulationRunId (GUID)	use for identifying the correct record in the OSim DB (of my own requested simulatio run)	simulationRunId (GUID)
	do not change	simulationOwner (GUID)
	do not change	simulationDescription (VARCHAR(1000))
simulationTimestamp (DATETIME)	set value	simulationTimestamp (DATETIME, NULL)
simulationDataQuality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
	set to 11 (Simulation executed)	simulationStatus (INTEGER)
For all entities related to the simulation result "Updated" (shipments, handling_units, material_batches) use the description of the API function setResult()		

Rest API specification (JSON)

Exemplary JSON object for getScenarioInput(inputData) Function


```
{
  "scenarioID": "f1b56b2b-ee4c-4bf4-8042-8e18b9a4b199",
  "scenarioTitle": "test johannes",
  "scenarioParameters": [
    {
      "parameterId": "20666b3e-09c5-469d-85f3-fb95afcc2bc1",
      "parameterScenario": 0,
      "parameterMaterialId": "fc4ad2aa-5e38-495c-b3b3-58c1f104cd1d",
      "parameterDeliveryDateInitial": "2023-08-31T22:00:00.000Z",
      "parameterDeliveryDateUpdated": "2023-09-01T22:00:00.000Z",
      "parameterQuantityInitial": 1,
      "parameterQuantityUpdated": 2,
      "parameterQuantityUnitId": "615ca346-2c64-475a-bf59-98de9ae51f79",
      "parameterOrderId": "abc",
      "parameterComment": "for fun"
    }
  ],
  "ScenarioSimulations": {
    "simulation_run_updated": [
      {
        "simulationRunId": "875745b8-73b8-429a-b4e7-d365873e35f2",
        "simulationDescription": "test run updated"
      }
    ],
```

```
    "simulationRunInitial": [
      {
        "simulationRunId": "875745b8-73b8-429a-b4e7-d365873e35f2",
        "simulationDescription": "test run initial"
      }
    ]
  }
}
```

Exemplary JSON object for SetScenarioSimResult() Function

```
{
 "ScenarioSimulations": {
  "simulationRunUpdated": [
{
  "simulationRunId": "3aa5b778-225f-4320-8c63-40d5543f3f09",
  "simulationTimestamp": "2022-11-14T11:31:16+01:00",
  "simulationComment": "Postman Data",
  "simulationDataQuality": "0",
  "simulationExpirationTimestamp": "2022-12-04T11:29:16+01:00",
  "shipments": [
    {
      "shipmentLogistics": "DE-Log-07",
      "handlingUnits": [
        {
          "materialBatches": [
            {
              "batchQuantity": "100",
              "batchNumber": "Batch_1",
              "batchUom": "Stk",
              "batchExpirationTimestamp": "2024-07-18T08:11:00",
              "materialHazardousGoods": "False",
              "materialNumber": "KK1000KTA",
              "materialName": "KK1000EMA-Elektronikmodul-A",
              "batchOrderId": "Order-1001",
              "batchSerialNumber": ""
            },
            {
              "batchQuantity": "50",
              "batchNumber": "Batch_2",
              "batchUom": "Stk",
              "batchExpirationTimestamp": "2024-07-19T08:10:59.995",
              "materialHazardousGoods": "False",
              "materialNumber": "KK1000KTB",
              "materialName": "KK1000EMA-Elektronikmodul-B",
              "batchOrderId": "Order-1001",
              "batchSerialNumber": ""
            }
          ],
          "hutName": "Pallette",
          "handlingUnitId": "HUT_1",
```

```
        "handlingUnitAmount": "1",
        "handlingUnitWeight": "102",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-25T09:00:00",
    "shipmentSplittingAllowed": "False",
    "shipmentPreceding": "IT-Werk-10",
    "shipmentRecipientTimestampPlanned": "2022-08-25T09:00:00",
    "shipmentId": "nl2321"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
      {
        "materialBatches": [
          {
            "batchQuantity": "100",
            "batchNumber": "Batch_3",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-20T08:10:59.995",
            "materialHazardousGoods": "False",
            "materialNumber": "KK1000KTA",
            "materialName": "KK1000EMA-Elektronikmodul-A",
            "batchOrderId": "Order-1002",
            "batchSerialNumber": ""
          },
          {
            "batchQuantity": "50",
            "batchNumber": "Batch_4",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-21T08:10:59.995",
            "materialHazardousGoods": "False",
            "materialNumber": "KK1000KTB",
            "materialName": "KK1000EMA-Elektronikmodul-B",
            "batchOrderId": "Order-1002",
            "batchId": ""
          }
        ],
        "hutName": "Pallette",
        "handlingUnitId": "HUT_2",
        "handlingUnitAmount": "1",
        "handlingUnitWeight": "102",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-29T09:00:00",
```

```
    "shipmentSplittingAllowed": "False",
    "shipmentPreceding": "IT-Werk-10",
    "shipmentRecipientTimestampPlanned": "2022-08-29T09:00:00",
    "shipmentId": "nl2322"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
      {
        "materialBatches": [
          {
            "batchQuantity": "100",
            "batchNumber": "Batch_5",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-22T08:10:59.995",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTA",
            "materialName": "KK1000EMA-Elektronikmodul-A",
            "batchOrderId": "Order-1003",
            "batchSerialNumber": ""
          },
          {
            "batchQuantity": "50",
            "batchNumber": "Batch_6",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-23T08:10:59.995",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTB",
            "materialName": "KK1000EMA-Elektronikmodul-B",
            "batchOrderId": "Order-1003",
            "batchSerialNumber": ""
          }
        ],
        "hutName": "Pallette",
        "handlingUnitId": "HUT_3",
        "handlingUnitAmount": "1",
        "handlingUnitWeight": "102",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-29T09:00:00",
    "shipmentSplittingAllowed": "False",
    "shipmentPreceding": "IT-Werk-10",
    "shipmentRecipientTimestampPlanned": "2022-08-29T09:00:00",
    "shipmentId": "nl2323"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
```

```
      {
        "materialBatches": [
          {
            "batchQuantity": "100",
            "batchNumber": "Batch_7",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-24T08:10:59.995",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTA",
            "materialName": "KK1000EMA-Elektronikmodul-A",
            "batchOrderId": "Order-1004",
            "batchSerialNumber": ""
          },
          {
            "batchQuantity": "50",
            "batchNumber": "Batch_8",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-25T08:10:59.995",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTB",
            "materialName": "KK1000EMA-Elektronikmodul-B",
            "batchOrderId": "Order-1004",
            "batchSerialNumber": ""
          }
        ],
        "hutName": "Pallette",
        "handlingUnitId": "HUT_4",
        "handlingUnitAmount": "1",
        "handlingUnitWeight": "102",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-31T09:00:00",
    "shipmentSplittingAllowed": "False",
    "shipmentPreceding": "IT-Werk-10",
    "shipmentRecipientTimestampPlanned": "2022-08-31T09:00:00",
    "shipmentId": "nl2324"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
      {
        "materialBatches": [
          {
            "batchQuantity": "100",
            "batchNumber": "Batch_9",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2024-07-26T08:10:59.995",
            "materialHazardousQoods": "False",
```

```
          "materialNumber": "KK1000KTA",
          "materialName": "KK1000EMA-Elektronikmodul-A",
          "batchOrderId": "Order-1005",
          "batchSerialNumber": ""
        },
        {
          "batchQuantity": "50",
          "batchNumber": "Batch_10",
          "batchUom": "Stk",
          "batchExpirationTimestamp": "2024-07-27T08:10:59.995",
          "materialHazardousQoods": "False",
          "materialNumber": "KK1000KTB",
          "materialName": "KK1000EMA-Elektronikmodul-B",
          "batchOrderId": "Order-1005",
          "batchSerialNumber": ""
        }
      ],
      "hutName": "Pallette",
      "handlingUnitId": "HUT_5",
      "handlingUnitAmount": "1",
      "handlingUnitWeight": "102",
      "handlingUnitVolume": "1"
    },
    {
      "materialBatches": [
        {
          "batchQuantity": "100",
          "batchNumber": "Batch_9",
          "batchUom": "Stk",
          "batchExpirationTimestamp": "2024-07-26T08:10:59.995",
          "materialHazardousQoods": "False",
          "materialNumber": "KK1000KTA",
          "materialName": "KK1000EMA-Elektronikmodul-A",
          "batchOrderId": "Order-1005",
          "batchSerialNumber": ""
        },
        {
          "batchQuantity": "50",
          "batchNumber": "Batch_10",
          "batchUom": "Stk",
          "batchExpirationTimestamp": "2024-07-27T08:10:59.995",
          "materialHazardousQoods": "False",
          "materialNumber": "KK1000KTB",
          "materialName": "KK1000EMA-Elektronikmodul-B",
          "batchOrderId": "Order-1005",
          "batchSerialNumber": ""
        }
      ],
      "hutName": "Pallette",
      "handlingUnitId": "HUT__2",
      "handlingUnitAmount": "1",
```

```
        "handlingUnitWeight": "102",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-31T09:00:00",
    "shipmentSplittingAllowed": "False",
    "shipmentPreceding": "IT-Werk-10",
    "shipmentRecipientTimestampPlanned": "2022-08-31T09:00:00",
    "shipmentId": "nl2325"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
      {
        "materialBatches": [
          {
            "batchQuantity": "100",
            "batchNumber": "Batch_1",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2025-07-18T08:10:00",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTA",
            "materialName": "KK1000EMA-Elektronikmodul-A",
            "batchOrderId": "Order-0001",
            "batchSerialNumber": ""
          },
          {
            "batchQuantity": "50",
            "batchNumber": "Batch_2",
            "batchUom": "Stk",
            "batchExpirationTimestamp": "2025-07-19T08:10:00",
            "materialHazardousQoods": "False",
            "materialNumber": "KK1000KTB",
            "materialName": "KK1000EMA-Elektronikmodul-B",
            "batchOrderId": "Order-0001",
            "batchSerialNumber": ""
          }
        ],
        "hutName": "Pallette",
        "handlingUnitId": "HUT_1",
        "handlingUnitAmount": "1",
        "handlingUnitWeight": "189",
        "handlingUnitVolume": "1"
      }
    ],
    "shipmentRecipient": "DE-Werk-76",
    "shipmentDestination": "DE-Werk-76",
    "shipmentDestinationTimestamp": "2022-08-29T09:00:00",
    "shipmentSplittingAllowed": "False",
```

```
    "shipmentPreceding": "RO-Werk-31",
    "shipmentRecipientTimestampPlanned": "2022-08-29T09:00:00",
    "shipmentId": "S1-1"
  },
  {
    "shipmentLogistics": "DE-Log-07",
    "handlingUnits": [
      {
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            "materialName": "KK1000GB-Gehäuse-Blau",
            "batchOrderId": "Order-0001",
            "batchSerialNumber": ""
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            "materialName": "KK1000GB-Gehäuse-Blau",
            "batchOrderId": "Order-0003",
            "batchSerialNumber": ""
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            "materialName": "KK1000GB-Gehäuse-Blau",
            "batchOrderId": "Order-0004",
            "batchSerialNumber": ""
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            "materialName": "KK1000GR-Gehäuse-Rot",
            "batchOrderId": "Order-0005",
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        "materialName": "KK1000GB-Gehäuse-Blau",
        "batchOrderId": "Order-0005",
        "batchSerialNumber": ""
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              "batchOrderId": "Order-1001",
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              "batchUom": "Stk",
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              "materialHazardousQoods": "False",
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            "materialName": "KK1000EMA-Elektronikmodul-B",
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            "batchSerialNumber": ""
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            "batchUom": "Stk",
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            "materialName": "KK1000EMA-Elektronikmodul-B",
            "batchOrderId": "Order-1004",
            "batchSerialNumber": ""
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}

    ]
  }
}
```


Supplier / Customer Data Import: OSim Manager and local data source

There are various ways to transfer the elements of the supplier/customer network to the OSim Manager. In addition to manual data entry (see Master data and address authoring), the data could also be transferred directly from the CATENA-X network using an EXCEL import (see Excel-Import of the suplier/customer network) or via a REST API.

The OSIm data model provides the following 3 entities for managing this information:

- businessPartnerLegalEntity
- businessPartnerSite
- businessPartnerAddresses

Functional Modules

The function modules are intended to provide an overview of the functions and processes available.

Main landing page of OSim Manager

The landing page is the entry page to the application and provides access to all important functionalities.

The following specifies the implementation of this "landing page" in the OSim Demonstrator.

In other OSim implementations, the landing page might be implemented differently, but should provide most of the following information.

Suggestion for a landing page implementation

After starting the application and logging in, the landing page is called up. The landing page consists of tiles which

- lead as links to the most important overview pages, or
- display some selected information of the respective overview page.

The following tiles are offered:

- Tile "My OSim Manager
  - Owner name (from bpna), address (postal address)
  - Info on last own released (status released) simulation
    - when simulated
  - User name of the currently logged in user
- Tile "News
  - "Number of external messages
  - "Number of internal messages
  - "Number of scenario requests
- Tile "Event management"
  - Leads to the display of the "Event Monitoring" screen
- Tile "Scenario Management"
  - Leads to the display of the "Scenario List" screen
- Tile "Network and Simulation Overview
  - If necessary, fill with meaningful network icon
  - Only link to the Network Overview as specified in Supplier/Customer Network & Simulation Status Visualization
- Tile "Supplier/Customer Data Management
  - Fill with meaningful icon if necessary

- Only link to the Data Management as specified in Supplier/Customer Data management.

Supplier/Customer Data management

Supplier/Customer Data Management comprises two functionally separate elements:

- Maintenance of master data/address data of all known partners of the Osim Manager Owner.
- Maintenance of the Osim Manager Owner's Supplier/Customer Network, which typically only comprises a subset of all partners.

Master data and address authoring

A page is to be implemented on which the partners (possible roles: supplier, customer, and own address) are recorded, displayed in tabular form, and their data maintained.

The following variants are possible:

- Manual maintenance of the partner data.
- Import of a standard EXCEL file with the partner data.
- Optional: Importing the partner data via a REST API of the OSim Manager
- Import the data from the central services of CATENA-X into the OSim Manager.

The three options Manual, EXCEL, and CATENA-X services are also mapped as menu items in the frontend of the OSim Manager. The transfer of data via REST API is a pure backend function.

Independently of the data transfer, the data is stored in a local OSim Manager database. The display of the data is always based on the OSim Manager database.

In the future, there will always be partners who have little digitalization and cannot transfer the data automatically from an external system. For these partners, the possibility of manual input or EXCEL import will also have to be possible in the long term.

Functional Description

- Display of the partner data in tabular form:
  - The "own" address of the OSim Manager appears at the top.
  - Below this, the "Legal Entities" of all registered partners including the own address. By mouse click a Legal Entity can be marked and selected.
  - Below this, all "Sites" of the selected "Legal Entity" appear. By mouse click a "Site" can be marked and selected.

        - Below that, all "Addresses" of the selected "Site" appear. An "Address" is the lowest hierarchical level and represents a physical address from/to which the goods are delivered.
        - A search functionality allows to filter the list by individual attribute values and thus to narrow down the number of displayed partners.
- At each hierarchy level there is a "New" button that can be used to create a new element. The data to be entered correspond to those defined in the data model.
- Editing the data
    - Any element of any hierarchy level can be selected by mouse click and then edited using the "Edit" button.
    - Likewise, a "Delete" button allows deleting the element.
    - A button "Delete all data" allows to delete the whole database.
- Button 'EXCEL Import'
    - There is a button that allows to import partner data from an Excel file. For details see Excel-Import of the suplier/customer network.
- Optional: Button 'Import supplier / customer network from CATENA-X'.
    - Import via CATENA-X network
        - The data is imported via a standard CATENA-X interface from the central services (BPN).
        - The data is stored in the internal OSim database.

Excel - Import of the Supplier/Customer network

This function is used to import master data on the partner into the OSim Manager database. The data contained in a defined Excel template is read out, prepared and inserted into the database.

Functional Description

The Excel import takes place in 3 steps:

- First, data is read line by line for each Excel worksheet.
- Then the values are transformed or converted into the target format for each attribute according to the instructions given below
- Finally, the new record is inserted into the database.

Special features of the import:

- If a row is already contained in the database, an update is performed automatically.
- If the data are contradictory, the insert is aborted with an error message and the complete import attempt is rolled back.

Excel Template	Transformation	Target DB-Attribute
business_partner_legal_entity	**---->>>>>>------**	**business_partner_legal_entity**

-	generate a new GUID	bpnlId
bpnl_external_id	keep the values from excel	bpnlExternalId
bpnl_cx_managed	keep the values from excel	bpnlCxManaged
bpnl_company_name	keep the values from excel	bpnlCompanyName
bpnl_contact_name	keep the values from excel	bpnlContactName
bpnl_contact_email	keep the values from excel	bpnlContactEmail
bpnl_contact_phone	keep the values from excel	bpnlContactPhone
	null	bpnlAddressHeadquarter
business_partner_site	**---->>>>>>------**	**business_partner_site**
-	generate GUID	bpnsId
bpnl_external_id	transform external ID into internal GUID	bpnsLegalEntity
bpns_external_id	keep the values from excel	bpnsExternalId
bpns_name	keep the values from excel	bpnsName
bpns_cx_managed	keep the values from excel	bpnsCxManaged
business_partner_addresses	**---->>>>>>------**	**business_partner_addresses**
-	generate GUID	bpnaId
bpns_external_id	transform external ID into internal GUID	bpnaSite
bpna_external_id	keep the values from excel	bpnaExternalId
bpna_name	keep the values from excel	bpnaName
bpna_country	keep the values from excel	bpnaCountry
bpna_postcode	keep the values from excel	bpnaPostcode
bpna_city	keep the values from excel	bpnaCity
bpna_street	keep the values from excel	bpnaStreet
bpna_building	keep the values from excel	bpnaBuilding
bpna_cx_managed	keep the values from excel	bpnaCxManaged
bpna_contact_name	keep the values from excel	bpnaContactName
bpna_contact_email	keep the values from excel	bpnaContactEmail
bpna_contact_phone	keep the values from excel	bpnaContactPhone
business_partner_legal_entity_adresses	**---->>>>>>------**	**business_partner_legal_entity**
bpnl_external_id	transform external ID into internal GUID	-
bpna_external_id	transform external ID into internal GUID	-

	perform an update of business_partner_legal_entity	bpnlAddressHeadquarter
partner_network_successors	**---->>>>>>------**	**partner_network_successors**
bpna_external_id_successor_production	transform external ID into internal GUID	bpnaSuccessorProduction
bpna_external_id_successor_logistics	transform external ID into internal GUID	bpnaSuccessorLogistics
partner_network_predecessors	**---->>>>>>------**	**partner_network_predecessors**
bpna_external_id_predecessor_production	transform external ID into internal GUID	bpnaPredecessorProduction
bpna_external_id_predecessor_logistics	transform external ID into internal GUID	bpnaPredecessorLogistics

More Information regarding data templates can be found in the chapter "Test Data"

Supplier/Customer Network configuration

A page has to be implemented where the Supplier/Customer Network can be configured and displayed.

The Supplier/Customer Network describes the supply relationships the owner of the OSim Manager has, and is therefore the basis for the exchange of simulation data with Catena-X partners (OneUp/OneDown principle).

The configuration is independent of the maintenance of the partner data, but arranges existing partners in a network.

The network is defined by the own address (obviously) plus a set of so called "Predecessor Pairs" and "Successor Pairs". Their exact role is specified in Data Model.

Functional Description

User Interface:

The user interface contains two tabs/views:

- Configuration: Here the set of defined predecessor and sucessor pairs is displayed and can be edited.
- Overview: Here the defined Supplier/Customer Network is displayed as a graph.

Configuration:

- A "New" button allows the creation of a new predecessor/successor pair.
    - Selection (via radio button) whether it is a Predecessor or Sucessor Pair
    - Selection of the Production Predecessor/Successor from the list of all addresses in the partner database
    - Optional selection of the Logistics Predecessor/Successor from the list of all addresses in the partner database.
- The set of already defined Predecessor and Sucessor pairs is displayed in tabular form.
- Mouse click on an element of the list marks it. The marked pair can then be edited or deleted using the corresponding buttons.

Overview:

- The owner (can be Production or Logistics) is shown in the center of the display.
- to the left all Predecessor Pairs (consisting of Producers and optionally Logistics) are displayed in a graph structure.
- to the right, all Successor Pairs (consisting of Producers and optionally Logistics) are displayed in a graph structure.

Supplier/Customer Network & Simulation Status Visualization

This dialogue page is intended to enable the display of all partners participating in the Catena-X/OSIM network according to the OneUp/OneDown principle.

The main overview only shows the allocation of customers, suppliers and logisticians in relation to one's own operation. On this page you can see the name of the partner, the date of the last simulation and the status of the simulation.

To view the detailed results, jump to the detailed view.

For communication with the partners, the jump to the news page is enabled via buttons and icons.

Functional Description

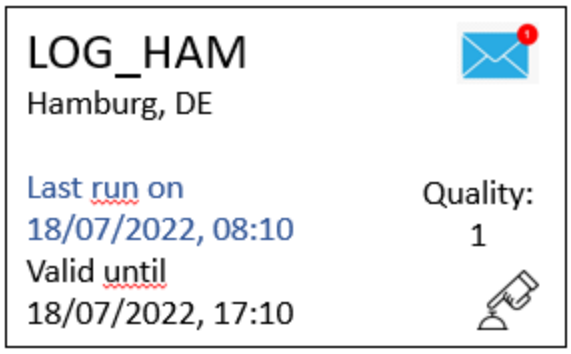
<u>Visualization:</u>

- Supplier / Customer Network OneUp / OneDown visualised
    - Logistics + Production
    - own operation
    - as well as the business relationship as a line

- In each tile of the individual partners the following attributes are displayed
    - Name (bpna_name, bpna_city, bpna_country)
    - Quality of the simulation
    - Date/time of the last released simulation run with a link to the "Display of simulation detail results" screen
    - Validity of the simulation
    - Simulation status
        - for simulation_expiration_timestamp not expired: text color black
        - otherwise: text color red
    - Additionally for the tile of the own operation
        - Date/time of the last simulation run (link to simulation view)
    - Additionally for the tiles of the OSim partner
        - Indication (possibly in colour) of whether the currently released simulation run has been taken into account in the released simulation run of your own company. This display is intended to help you recognise whether your own simulation results are up to date. The greater the number of partner simulations not taken into account, the more urgent the need to carry out your own simulation.
          Note: This indicator is not included in the current OSim Manager database model.

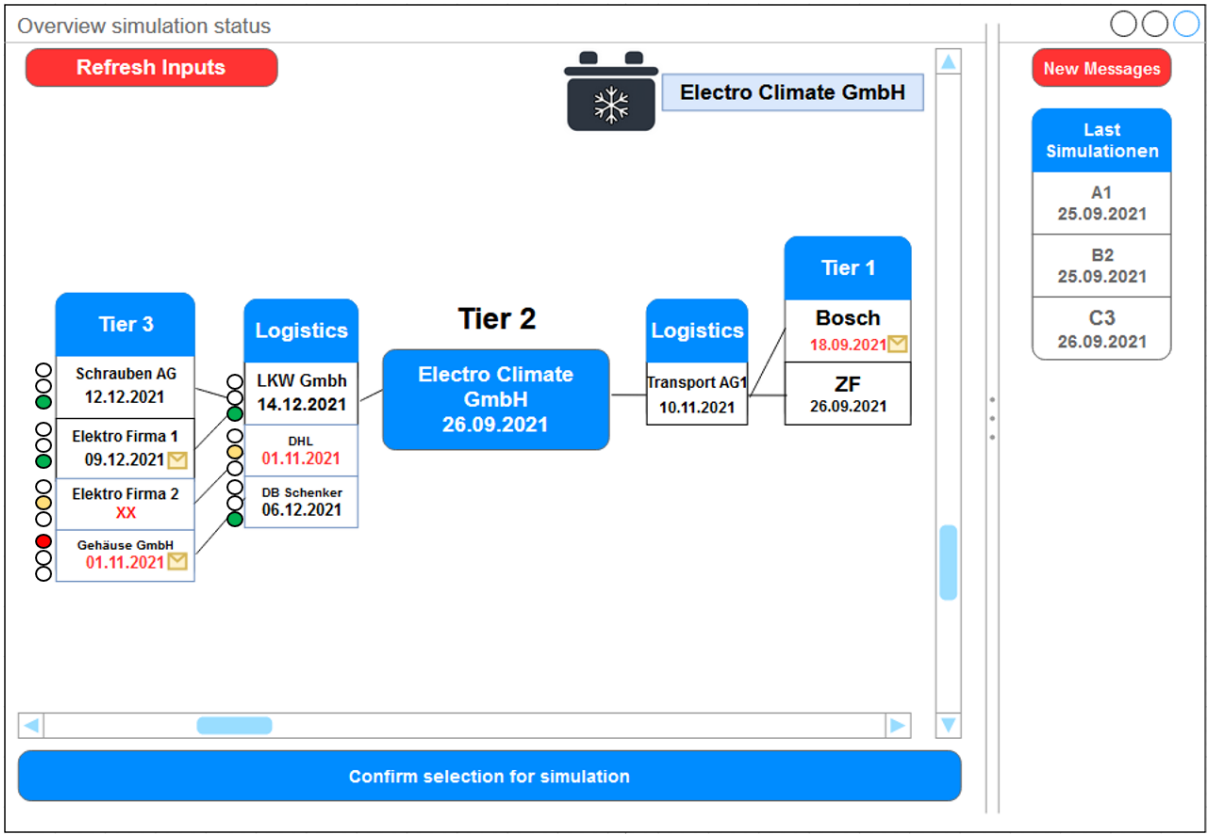
- The following actions are possible in each tile of the individual partners
    - "Message" icon
        - Link to the message page
        - Icon with number of unread messages from the partner
    - "Request Simulation" icon
        - Own operation: When activated
            - an entry is created in the entity Simulations with status 0. This is the trigger to run a simulation in the own operation.
            - Another icon (e.g. an hourglass) symbolises the active simulation request.
        - Partner Operation: When activated
            - the API requestLatestSimulationResult() of the partner interface is called up

- Button "Reguest SimResults all partners" to request the simulation results of all direct partners.
    - For this, the API requestLatestSimulationResult() is called in a loop for the direct predecessors.



Mockup

Show Supplier / Customer Network:



Display of simulation detail results

This dialogue page appears when you click in one of the company tiles in the supplier tree of the Supplier / Customer network on an available simulation, or if in the simulation listing you select a simulation.

In general, the dialogue page shows the results of one simulation run of partner simulations and own simulations in the same way.

Functional Description

UI:

- The dialogue page shows the following information:
  - Header area:
    - Display of information about the simulation run, e.g..
      - Name and contact details of the company
      - Date of execution (=publication) of the simulation results
      - Information on the data quality (value) from the master data of the company, based on the simulation method, tools, degree of coverage of the process chain, etc.
    - Button "Release simulation". This is only available if simulation is the own and is in status 1 (Simulated). Consequence of this button is explained in the chapter Data Model at Attribute description for SimulationState.
  - Detail area:
    - Displays the results of the currently saved simulation run. This includes information on shipments, handling units and material batches (see data model). This display can also be realised, for example, by linking several masks to the individual entities (clicking on a shipment leads to the display of the handling units and also to the material batches).

Importing the simulation results from Excel

This function is used to import new simulation results into the OSim Manager database. The data contained in a defined Excel template is read out, prepared and inserted into the database.

Functional Description

The Excel import takes place in 3 steps:

- First, data is read line by line for each Excel worksheet.

- Then the values are transformed or converted into the target format for each attribute according to the instructions below.
- Finally, the new record is inserted into the database.

Special features of the import:

- Each Excel-file contains only results of one simulation run. For the import of several simulation runs, a corresponding number of Excel files must be created.
- If a simulation run of the same owner and status "released" (2) is already contained in the database, this simulation run is archived (status = 99) and the new entry is imported.
- If the data is contradictory, the insert is aborted with an error message and the complete import attempt is rolled back.

Excel-Template	Transformation	Target DB-Attribute
simulation_runs	**---->>>>>>------**	**simulation_runs**
simulation_run_id (VARCHAR(50))	generate a new GUID and use this in OSim DB. Use the Excel-value as a reference during the Imports	simulationRunId (GUID)
simulation_owner	Can be an internal ID or an external ID of the owner! Try to transform into the internal GUID as an external id first. If there is no match, then as an internal id. Otherwise -> error	simulationOwner (GUID)
simulation_description (VARCHAR(1000))	do not change	simulationDescription (VARCHAR(1000))
simulation_timestamp (DATETIME)	set value	simulationTimestamp (DATETIME, NULL)
simulation_data_quality (INTEGER, NULL)	set value	simulationDataQuality (INTEGER, NULL)
	set to 2 (released)	simulationStatus (INTEGER)
shipments	**---->>>>>>------**	**shipments**
shipment_id (VARCHAR(50))	generate a new GUID and use this in OSim DB. Use the Excel-value as a reference during the Imports	shipmentId (GUID)
shipment_simulation_run (VARCHAR(50))	use the generated value for simulation_run_id	shipmentSimulation_run (GUID)
shipment_destination (VARCHAR(255))	Can be an internal ID or an external ID of the destination! Try to transform into the internal GUID as	shipmentDestination (GUID)

	an external id first. If there is no match, then as an internal id. Otherwise -> error	
shipment_destination_timestamp (DATETIME)	set value	shipmentDestinationTimestamp (DATETIME)
shipment_recipient (VARCHAR(255))	Can be an internal ID or an external ID of the recipient! Try to transform into the internal GUID as an external id first. If there is no match, then as an internal id. Otherwise -> error	shipmentRecipient (GUID)
shipment_recipient_timestamp_planned (DATETIME)	set value	shipmentRecipientTimestampPlanned (DATETIME)
shipment_splitting_allowed (BOOLEAN)	set value	shipmentSplittingAllowed (BOOLEAN)
shipment_logistics (VARCHAR(255))	Can be an internal ID or an external ID of the logistics company! Try to transform into the internal GUID as an external id first. If there is no match, then as an internal id. Otherwise -> error	shipmentLogistics (GUID)
shipment_preceding (NULL only for production simulation)	set value	shipmentPreceding
handling_units	**---->>>>>>------**	**handling_units**
handling_unit_id (VARCHAR(50))	generate a new GUID and use this in OSim DB. Use the Excel-value as a reference during the Imports	handlingUnitId (GUID)
handling_unit_shipment (VARCHAR(50))	use the generated value for shipment_id	handlingUnitShipment (GUID)
hut_name (VARCHAR(100))	transform hut_name to Osim handling_unit_type (using table handling_unit_types, if necessary, creating a new entry there)	handlingUnitType (GUID)
handling_unit_volume (FLOAT)	set value	handlingUnitVolume (FLOAT)
handling_unit_weight (FLOAT)	set value	handlingUnitWeight (FLOAT)
handling_unit_amount (INTEGER)	set value	handlingUnitAmount (INTEGER)
material_batches	**---->>>>>>------**	**material_batches**
batch_id (VARCHAR(50))	generate a new GUID and use this in OSim DB. Use the Excel-value as a reference during the Imports	batchId (GUID)
batch_handling_unit (VARCHAR(50))	use the generated value for handling_unit_id	batchHandlingUnit (GUID)
material_number (VARCHAR(255))	transform material_number to Osim batch_material (using table materials (here	batchMaterial (GUID)

	local attribute is called material_id), if necessary, creating a new entry there)	
material_name (VARCHAR(255))	only verify if consistent with mapping above and if applicable add to new entry in table materials	
material_hazardous_goods (BOOLEAN)	only verify if consistent with mapping above and if applicable add to new entry in table materials	
batch_expiration_timestamp (DATETIME)	set value	batchExpirationTimestamp (DATETIME)
batch_quantity (INTEGER)	set value	batchQuantity (INTEGER)
uom_name (VARCHAR(100))	transform uom_name to Osim batch_uom (using table "units of measurement" (here local attribute is called uom_id), if necessary, creating a new entry there)	batchUom (GUID)
batch_number (VARCHAR(100)	set value	batchNumber (VARCHAR(100)
batch_order_id (VARCHAR(255))	set value	batchOrderId (VARCHAR(255))

More Information regarding data templates can be found in the chapter "Test Data"

Simulations overview

A page is to be implemented on which all simulation results available in the system are displayed in tabular form. These can be own simulation results as well as imported simulation results of the partners.

Optionally to simplify the search a filter option can be implemented that restricts the simulation runs according to time, status, owner and type.

To view the details of a simulation run, the mask "Display of simulation detail results" is provided. Navigation is done by double-clicking.

Regardless of the origin of the data, it is stored in the local OSim Manager database. The display is always based on the OSim Manager database.

Functional Description

- Presentation of the simulation run in tabular form with the following essential information:
    - Owner
    - Description
    - Timestamp

    - Expiration of Simulation
    - Data Quality
    - Status
- Clicking on a line leads to the details of the simulation run. The screen "Display of simulation detail results" is displayed.
- Button 'New Simulation Data import' allows import of simulation results via Excel. These can be own results as well as results of partner simulations.
    - If you import results from partner simulations, the previously imported simulation run data set is set to status 99 (Archived) and the currently imported set is set to status 2 (Released), since by design only simulation results in this status are made available by partners for collection.
    - If you import your own simulation results, this record is given the status 1 (Simulated).

Scenario Management

Introduction into Scenario Management

In the OSim environment, scenarios describe potentially changed situations in production or changed requirements that one would like to communicate to the supply chain partners and have the feasibility confirmed.

An important aspect of scenario management is the restriction of the consideration to material flow segments. A material flow segment corresponds to a chain "1 supplier → 0:n logistics provider → 1:n customer". If the analysis of a scenario reveals an impact on other material flow segments, the observer is responsible for confirming, forwarding or rejecting the scenario. An interweaving of different material flow segments is not supported for reasons of complexity!

In general, scenarios can be initiated by any partner involved in OSim (customers, suppliers, logisticians). The initiator is registered in the system as a scenario owner.

One of the most important specifications in scenario initiation is defining the role of the scenario owner, as this determines the direction and course of the scenario workflow. There are four possible roles:

1. supplier
2. customer
3. logisticianReceiving
4. logisticianSending

If the owner indicates that he is the **supplier** in the envisaged scenario, the scenario is used to simulatively check how the possible changes to the scenario owner would affect the supply chain towards the customer.

If the owner specifies that he is the **customer** in the envisaged scenario, the scenario is used to simulatively check how the owner's possible changes would affect the supply chain from his suppliers.

If the owner indicates that he is the **logisticianReceiving** of a supply chain section in the envisaged scenario, the scenario is used to simulatively check how the possible changes to the owner would affect the supply chain from the pick-up stations to the end customers of the goods to be transported.

If the owner indicates that he is the **logisticianSending** of a supply chain section in the envisaged scenario, the scenario is used to simulatively check how the possible changes at the owner would affect the supply chain from the logistician itself to the end customers of the goods to be transported.

Then, from the perspective of the specified role, information is provided that describes the envisaged scenario case as precisely as possible. These can be order-related parameters or a free-text description.

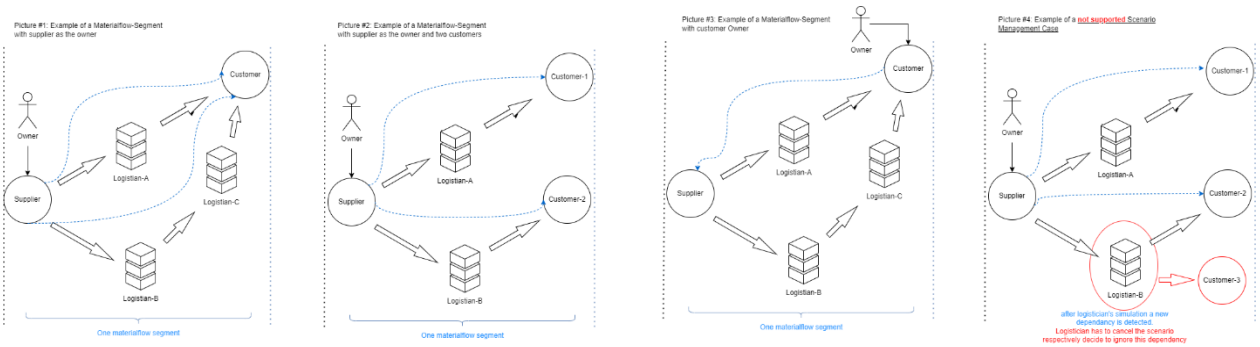
In the cases "Owner is supplier" or "Owner is logisticianSending", a simulation is triggered in order to recognise the effects of the intended change in the material flow on the direct network partners in the direction of the customer. Accordingly, the network partners concerned receive a request to validate whether the scenario can be fulfilled on the basis of the simulation results provided and using their own simulation tools.

In the cases "Owner is a customer" or "Owner is a logisticianReceiving", own simulation is not relevant for the first time, since the dependency is directly specified by the owner when entering the scenario parameter. Accordingly, the network partners concerned receive a request to validate whether the scenario can be fulfilled using the information in the scenario parameters and their own simulation tools.

The further course of scenario processing is identical in all four cases: The requested partner checks the feasibility by triggering its own simulation, analysing the simulation results for effects. If there are effects on the next partners in the same material flow segment, the request for confirmation of feasibility is forwarded until the end point of the scenario (= customer) is reached. After analysing their own simulation results, the customer reverses the validation by confirming or rejecting the feasibility. Similarly, all partners of the material flow segment confirm or reject the feasibility until the query chain reaches the owner.

As the last instance, the owner decides on the implementation of the scenario and informs all partners previously involved in the feedback with a recursive call.

For more information on the exact process of scenario-based interactions, see the chapter "Workflow in Scenario Management context"

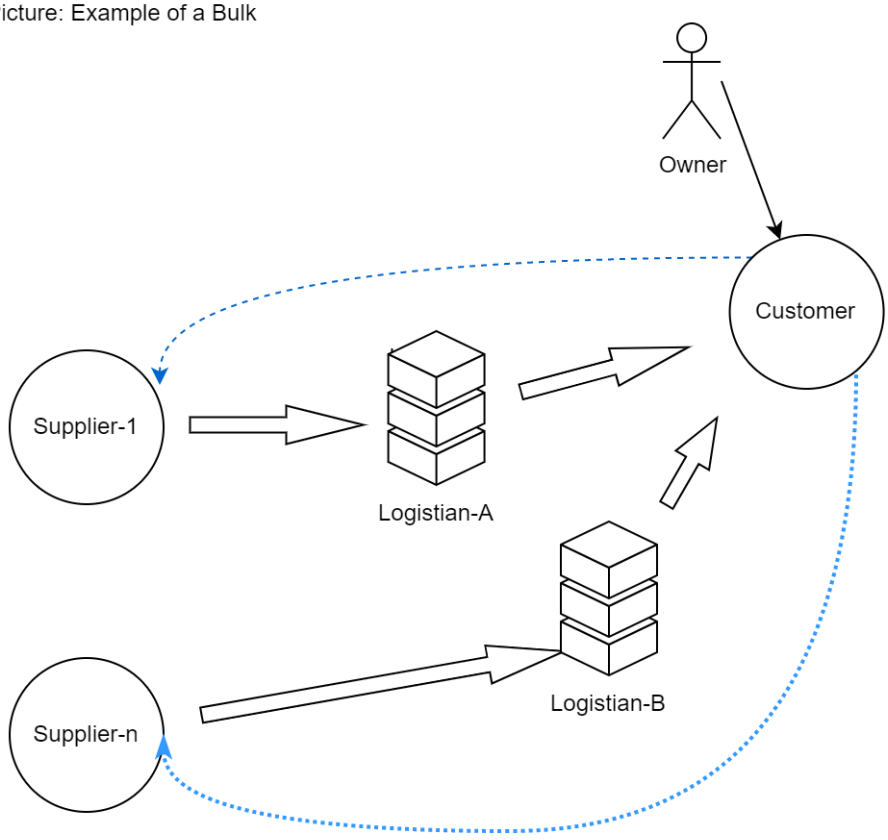


Grouping of scenarios into a bulk

In the role of "Customer" or " LogisticianReceiving" there are cases when several scenarios have to be initiated and considered at the same time. In these cases, one speaks of a bulk formation.

A bulk is defined as a grouping of several scenarios that are created simultaneously, run in parallel and then jointly evaluated by the owner. A bulk is considered confirmed when all individual scenarios of the bulk have been confirmed.

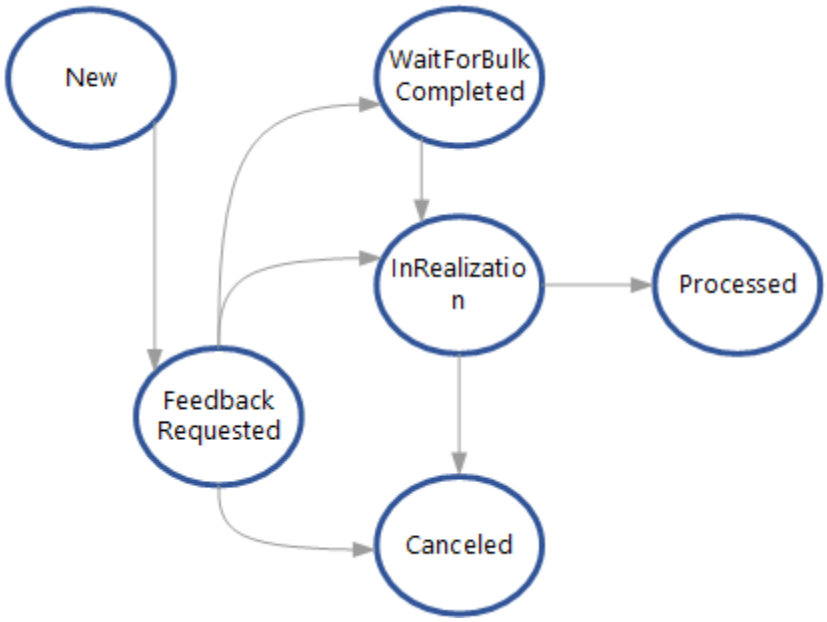
Picture: Example of a Bulk



State machine for scenarios

State value descriptions

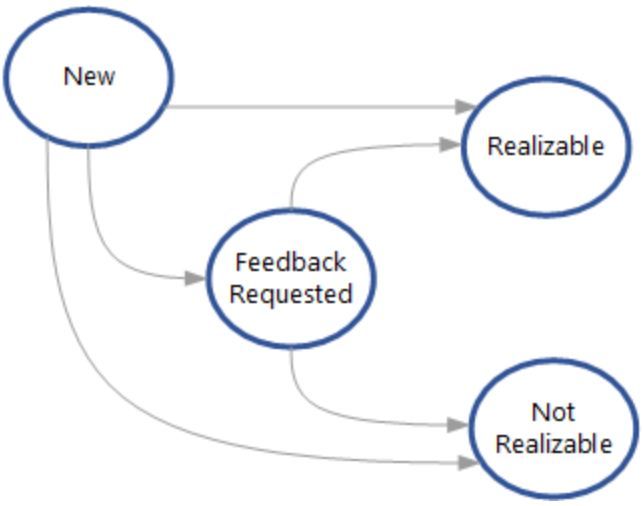
State	Description
New	New scenario configured
FeedbackRequested	Feedback request submitted to one or more affected partners
WaitForBulkCompleted	Flagged for bulk feedback (This scenario is confirmed, but not yet all scenarios of the bulk)
InRealization	Organisational measures initiated
Processed	Organisational measures implemented
Canceled	All affected partners informed about the termination



State machine for scenario iterations

State value descriptions

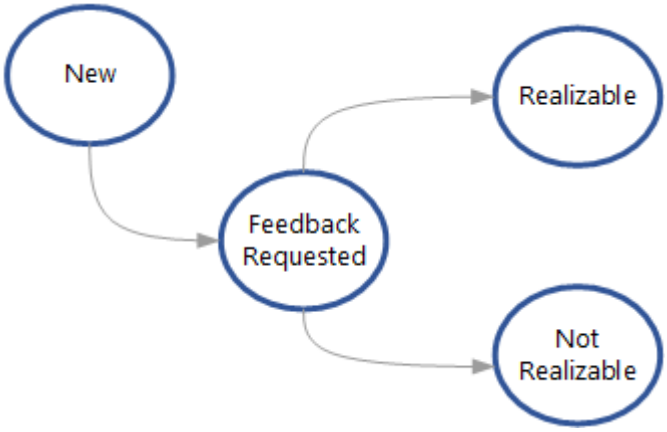
State	Description
New	New Iteration configured
FeedbackRequested	Feedback request submitted to one or more affected partners
Realizable	Communicated readiness for implementation to the requesting partners
NotRealizable	The requesting partner is informed of the refusal to implement the project.



State machine for feedback requests

State value descriptions

State	Description
New	New feedback request configured
FeedbackRequested	Feedback request submitted to the partner concerned
Realizable	The partner has confirmed the feasibility
NotRealizable	The partner has rejected the implementation



Data flows

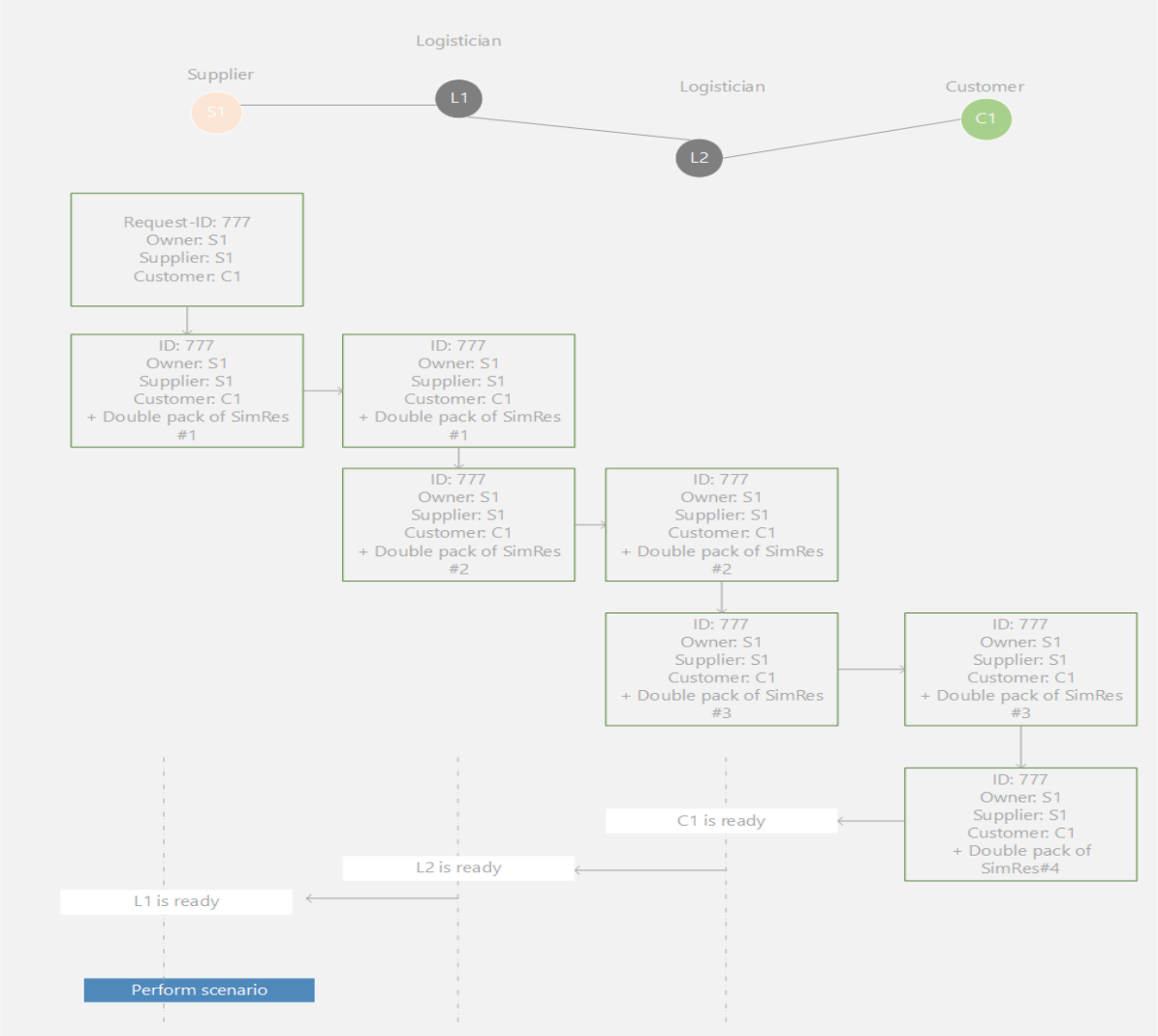
In scenario management, a distinction is made between 4 different types of scenarios:

- The data flow from suppliers to customers
- The data flow from customers to suppliers
- The data flow from the logistician to the customer
- The data flow from the logistician to the supplier

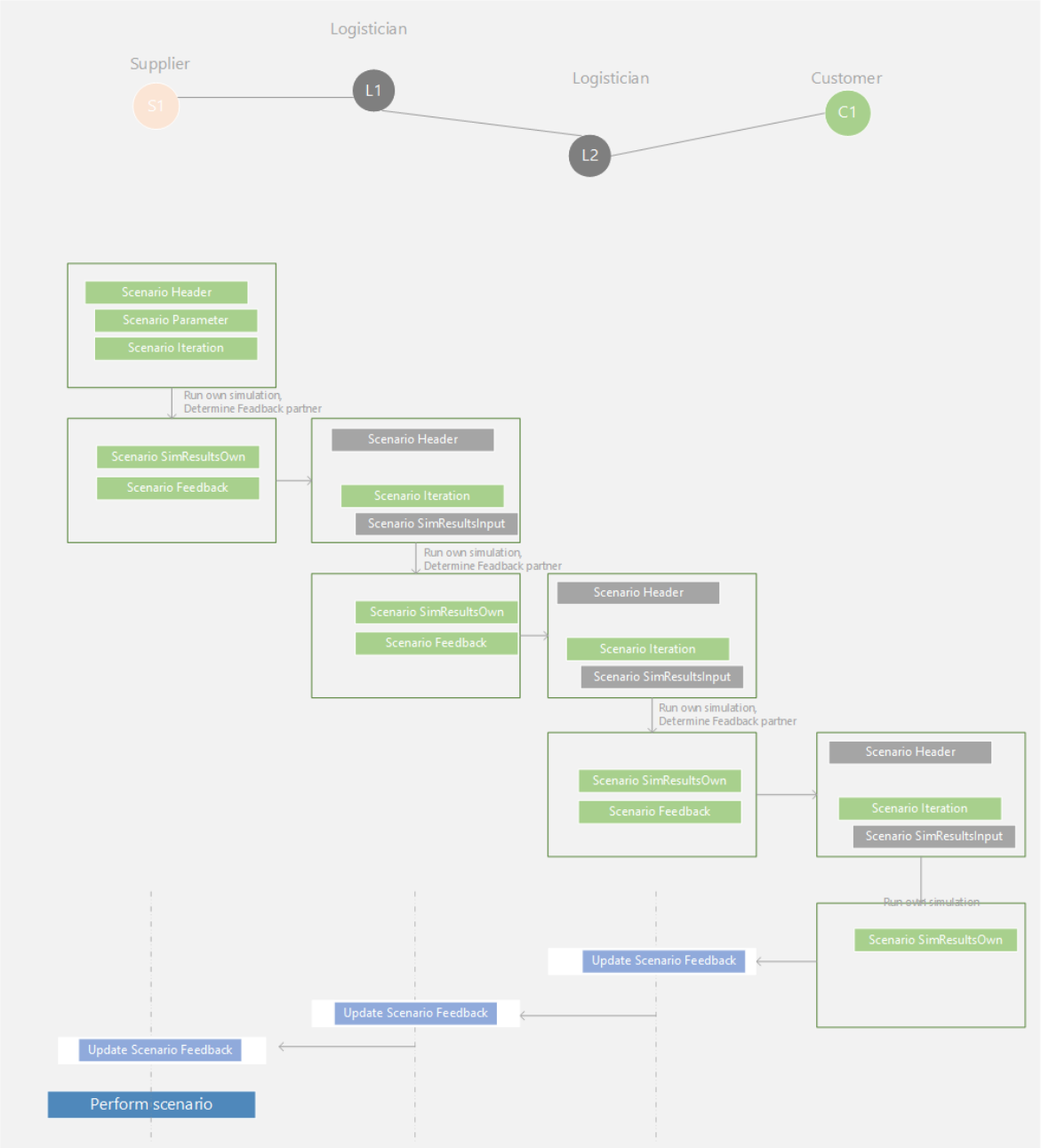
In the following, the types of scenarios are shown individually and the data flows are explained. The first image visualises the data flow and the second image additionally visualises the data records that are generated (GREEN) or transferred (GREY). The returning confirmations lead to the update of existing data records (BLUE).

The data flow from supplier to the customer

Request flow:

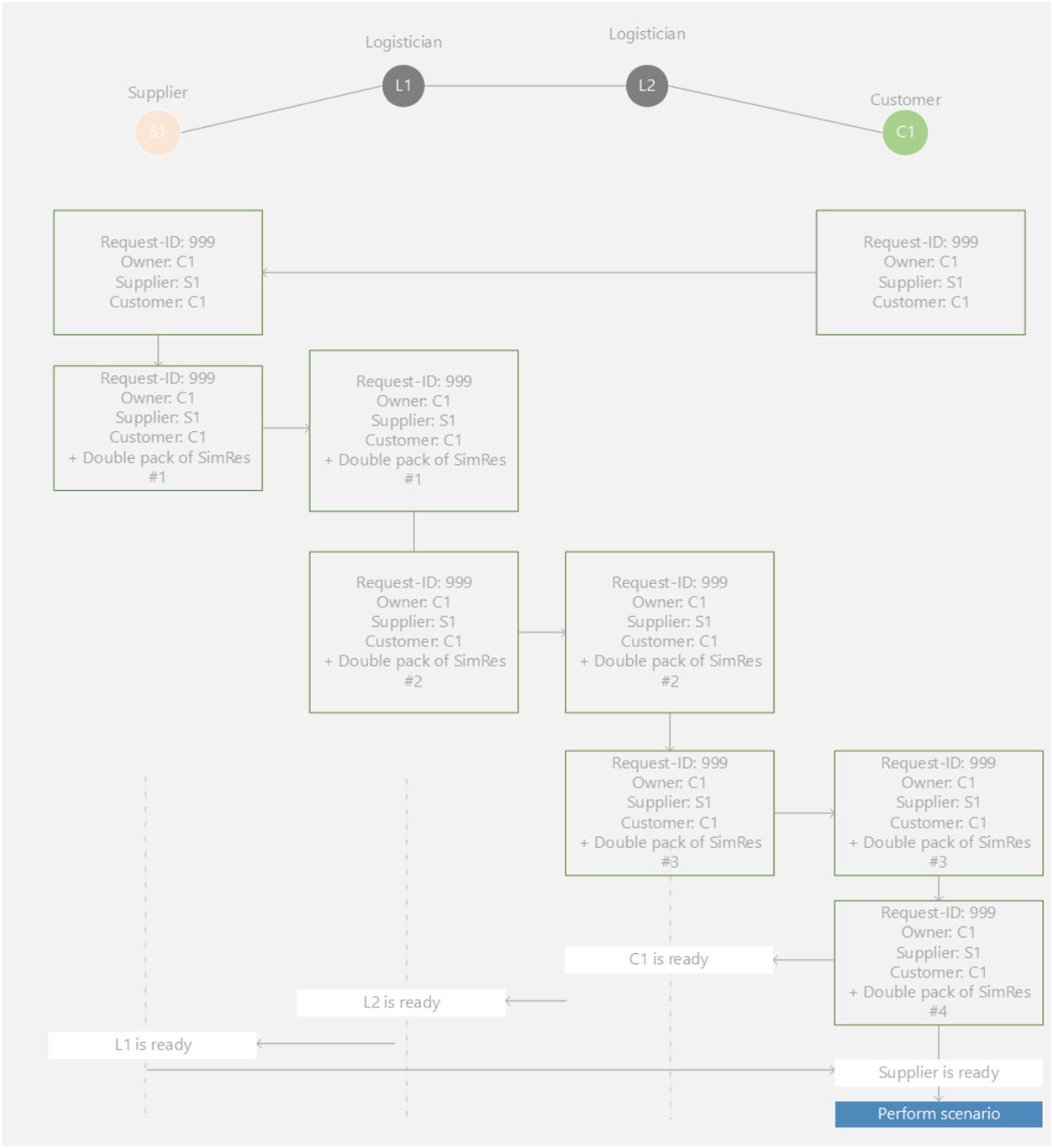


Data creation at the supply chanin instances:

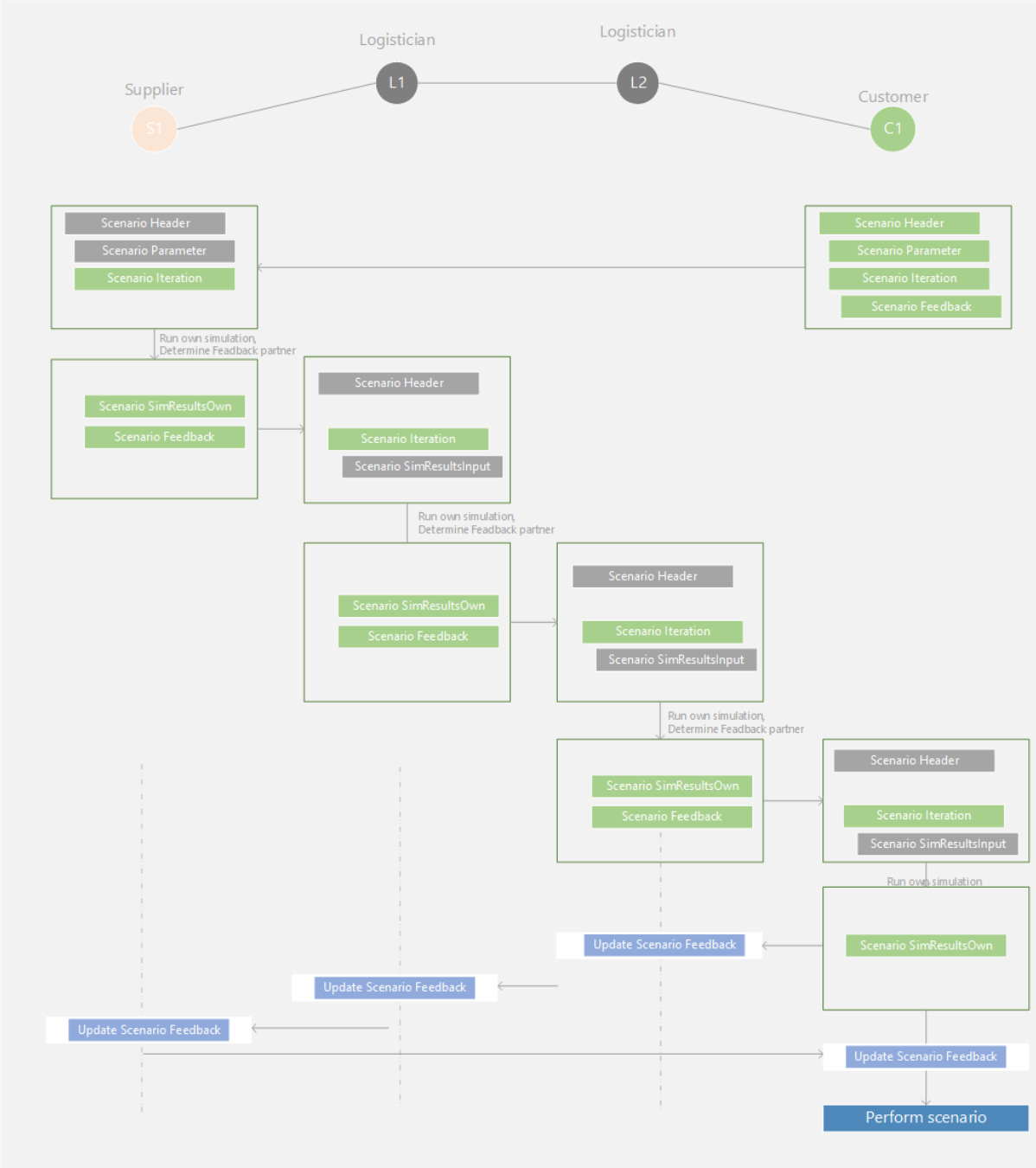


The data flow from customer to the supplier

Request flow:

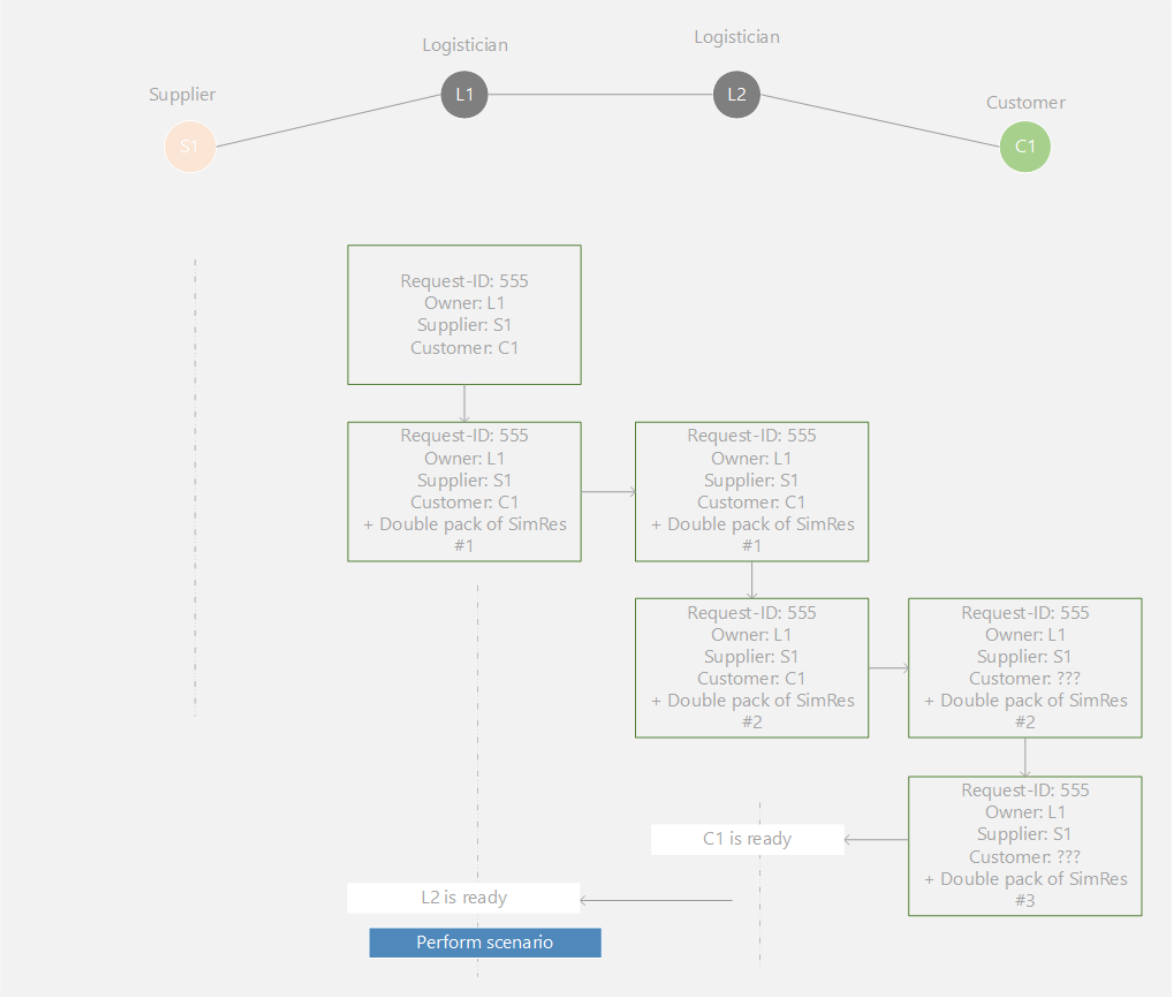


Data creation at the supply chanin instances:

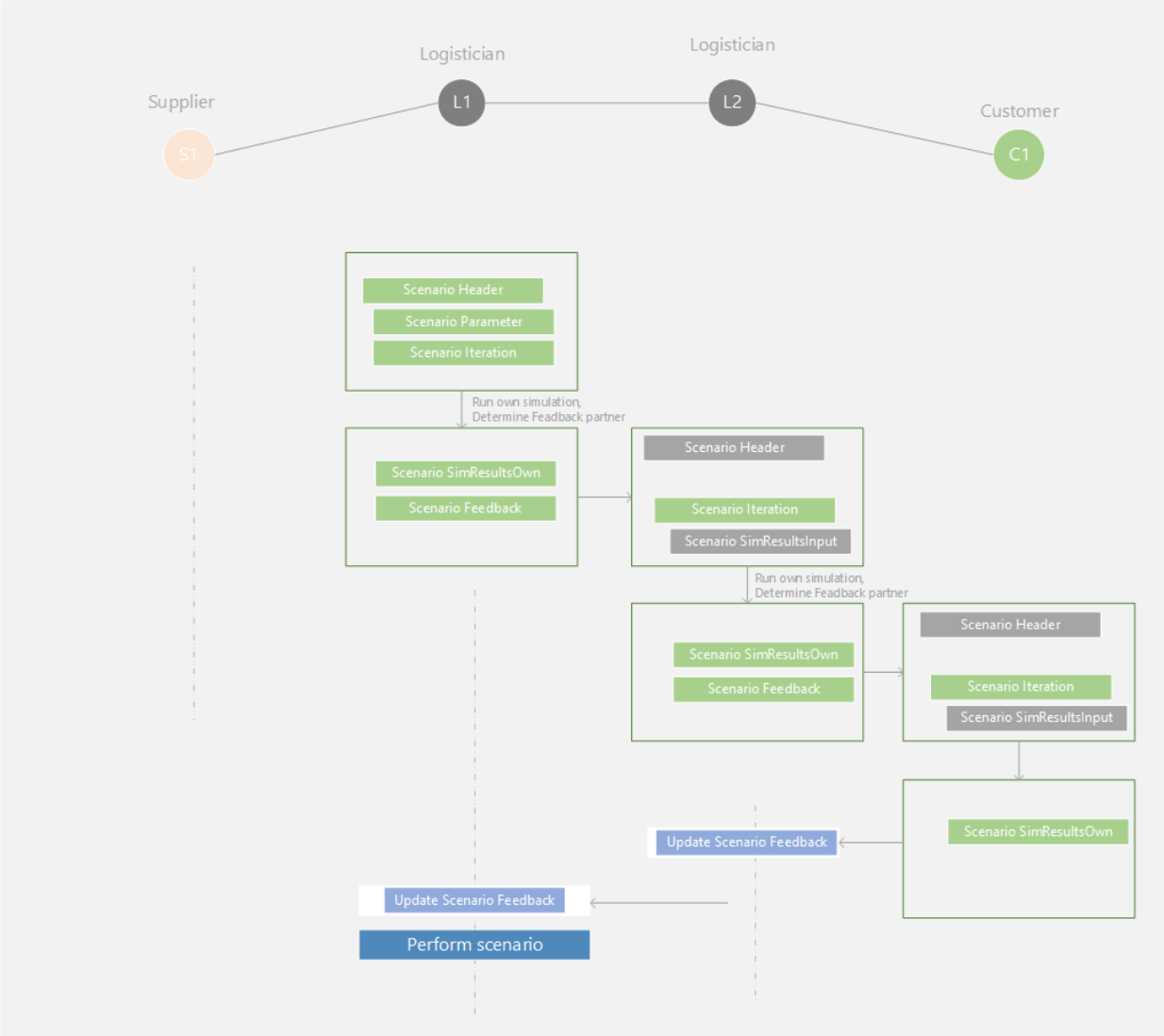


The data flow from logistician to the customer (logisticianSending)

Request flow:

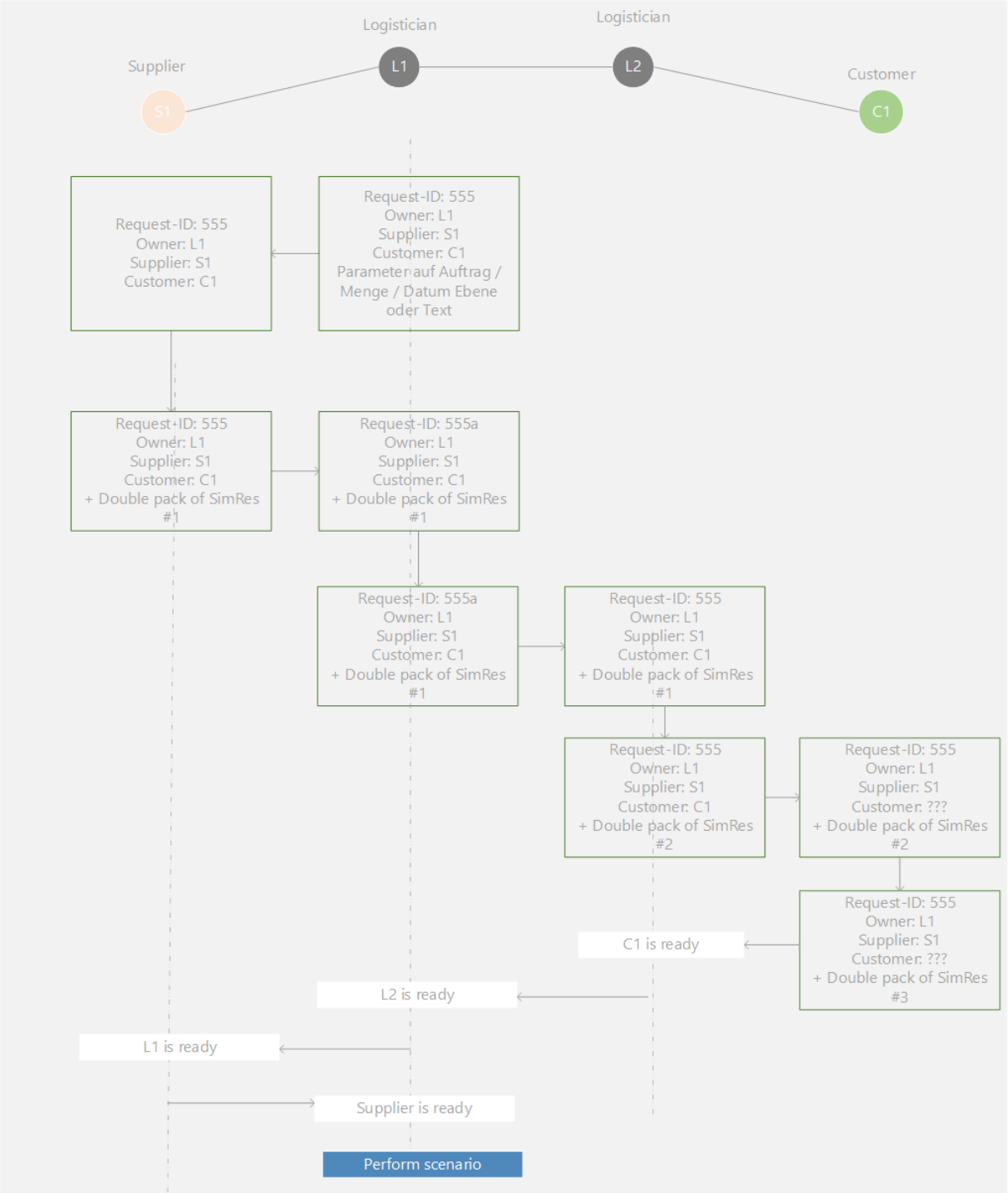


Data creation at the supply chanin instances:

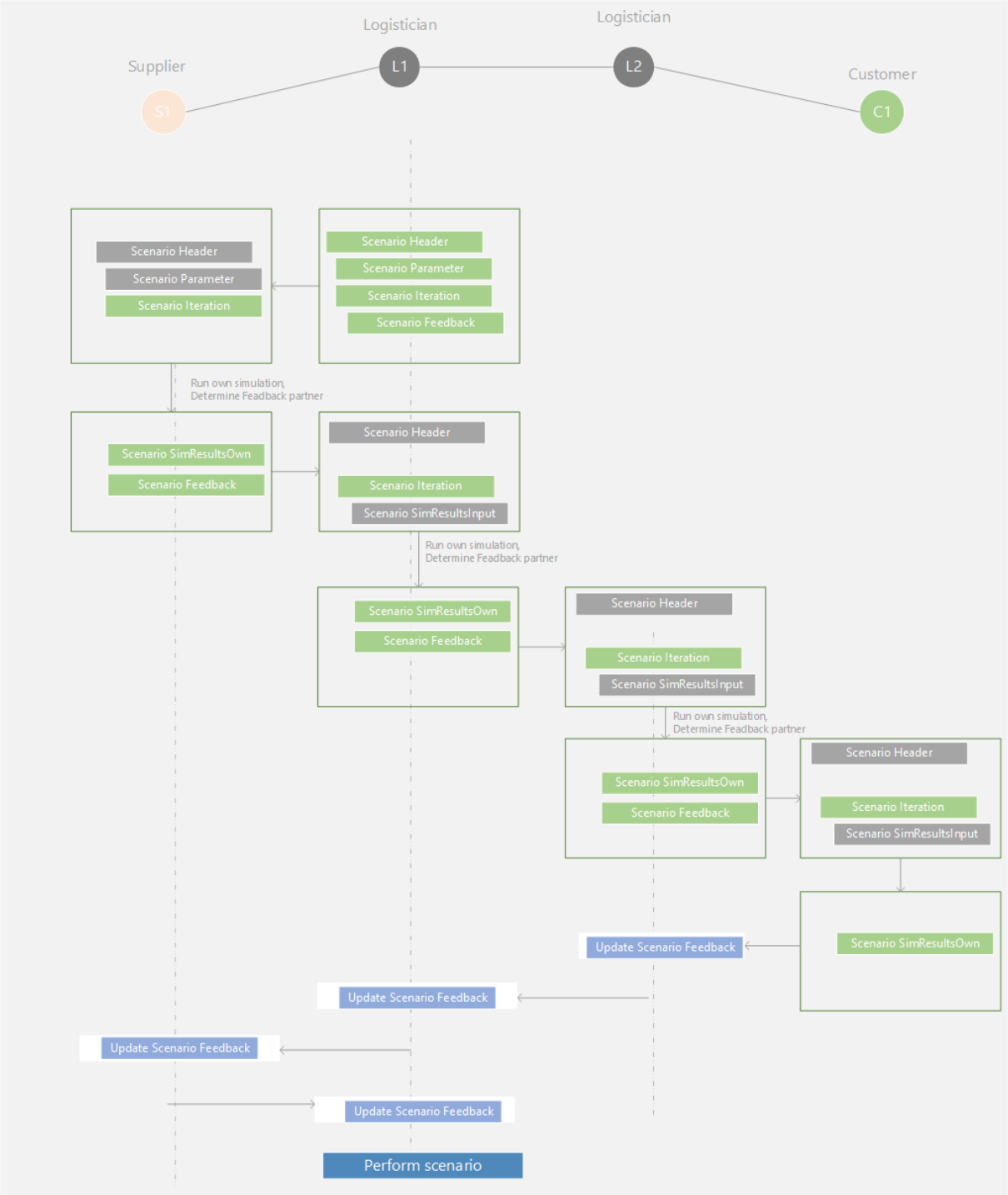


The data flow from logistician to the supplier (logisticianReceiving)

Request flow:



Data creation at the supply chain instances:



Simulations in Scenario Management context

Within the scope of scenario management, requests are made to perform simulations. These come exclusively via the OSim Manager and lead to a twofold simulation result:

- Basic Simulation and
- Simulation with consideration of the scenario parameters

Providing the result in this form enables the statement about the exact impact of the scenario request by means of a comparison. This way, the directly affected partners are identified and asked to provide feedback on the readiness for implementation by forwarding the scenario request in this way.

Workflow and Details

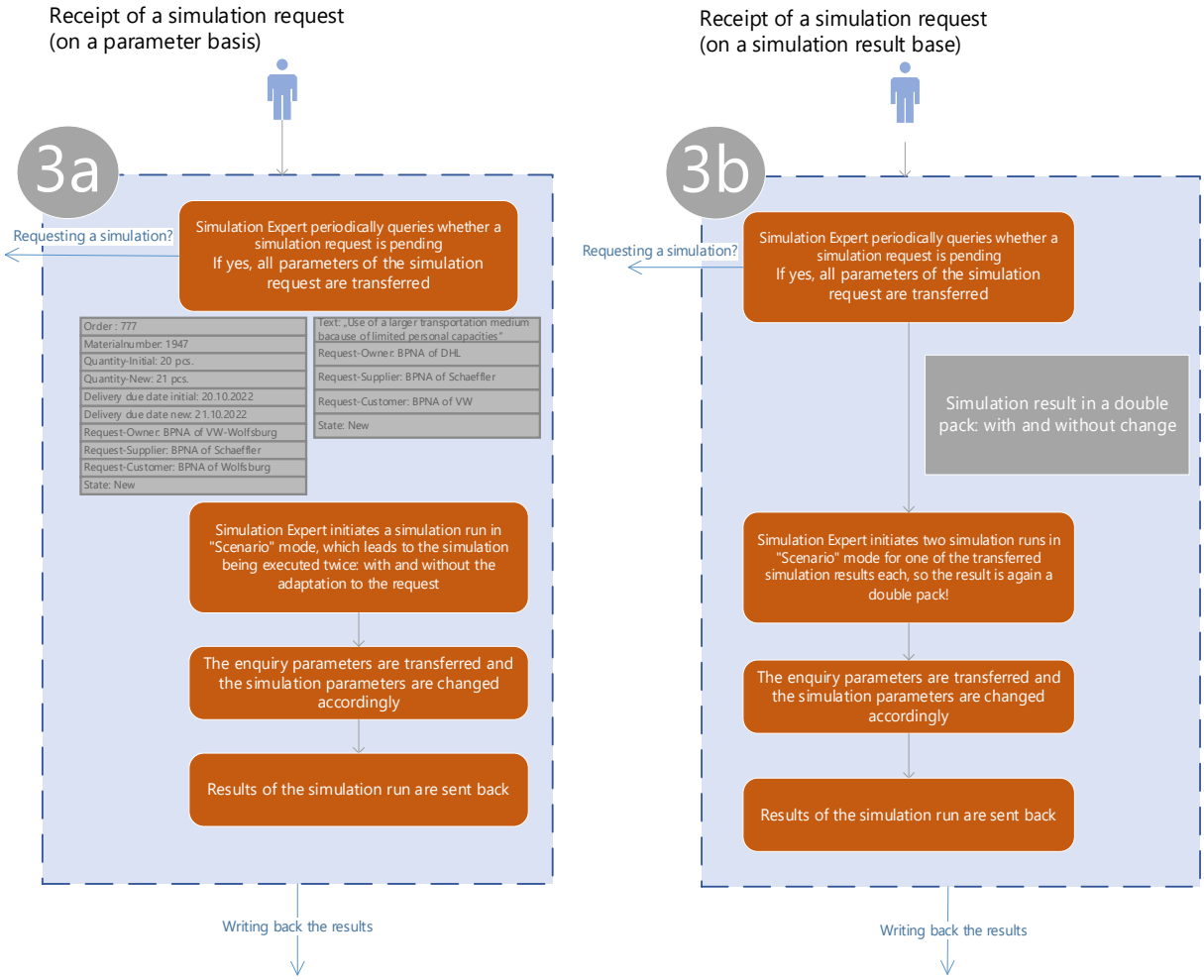
Generally there are (today's state!) 3 different trigger possibilities of a simulation request:

1. With textual description of the simulation target
2. Parametric (= order-oriented)
3. Simulation-result based

The first variant is a request to run the own simulation with the goal to hit the problem description closest. To do this, the simulation operator first runs a normal simulation. Makes adjustments to the simulation model settings or adjusts the simulation model and runs the second simulation. Both results are written back to the OSim Manager in a double pack.

The second variant is about automatically considering the order-related parameters from the call in the simulation model, if possible. Here, too, a normal simulation has to be carried out first and then the one based on the adjusted parameters. Both results are written back to the OSim Manager in a double pack.

The third one on two different input parameter sets. This means that first a simulation run is done based on the first input parameter set. The second one - based on the second input parameter set. Both results are written back to the OSim Manager in a double pack.



Workflows in Scenario Management context

the scope of scenario management, requests are made to perform simulations. These come exclusively via the OSim Manager and lead to a twofold simulation result:

- Basic simulation and
- Simulation with consideration of the scenario parameters

Providing the result in this form enables the statement about the exact impact of the scenario request by means of a comparison. This way, the directly affected partners are identified and asked to provide feedback on the readiness for implementation by forwarding the scenario request in this way.

Workflow and Details

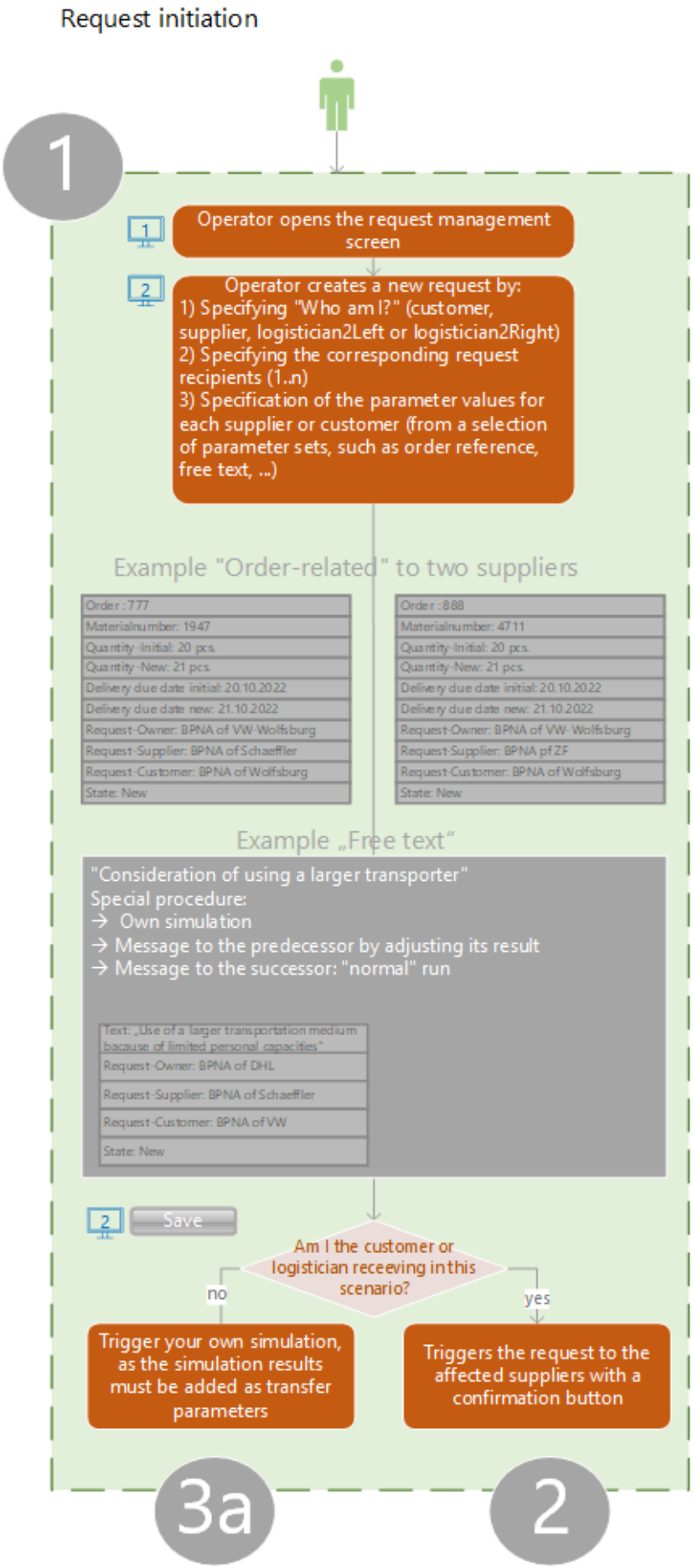
Generally there are (today's state!) 3 different trigger possibilities of a simulation request:

1. With textual description of the simulation target
2. Parametric (= order-oriented)
3. Simulation-result based

The first variant is a request to run the own simulation with the goal to hit the problem description closest. To do this, the simulation operator first runs a normal simulation. Makes adjustments to the simulation model settings or adjusts the simulation model and runs the second simulation. Both results are written back to the OSim Manager in a double pack.

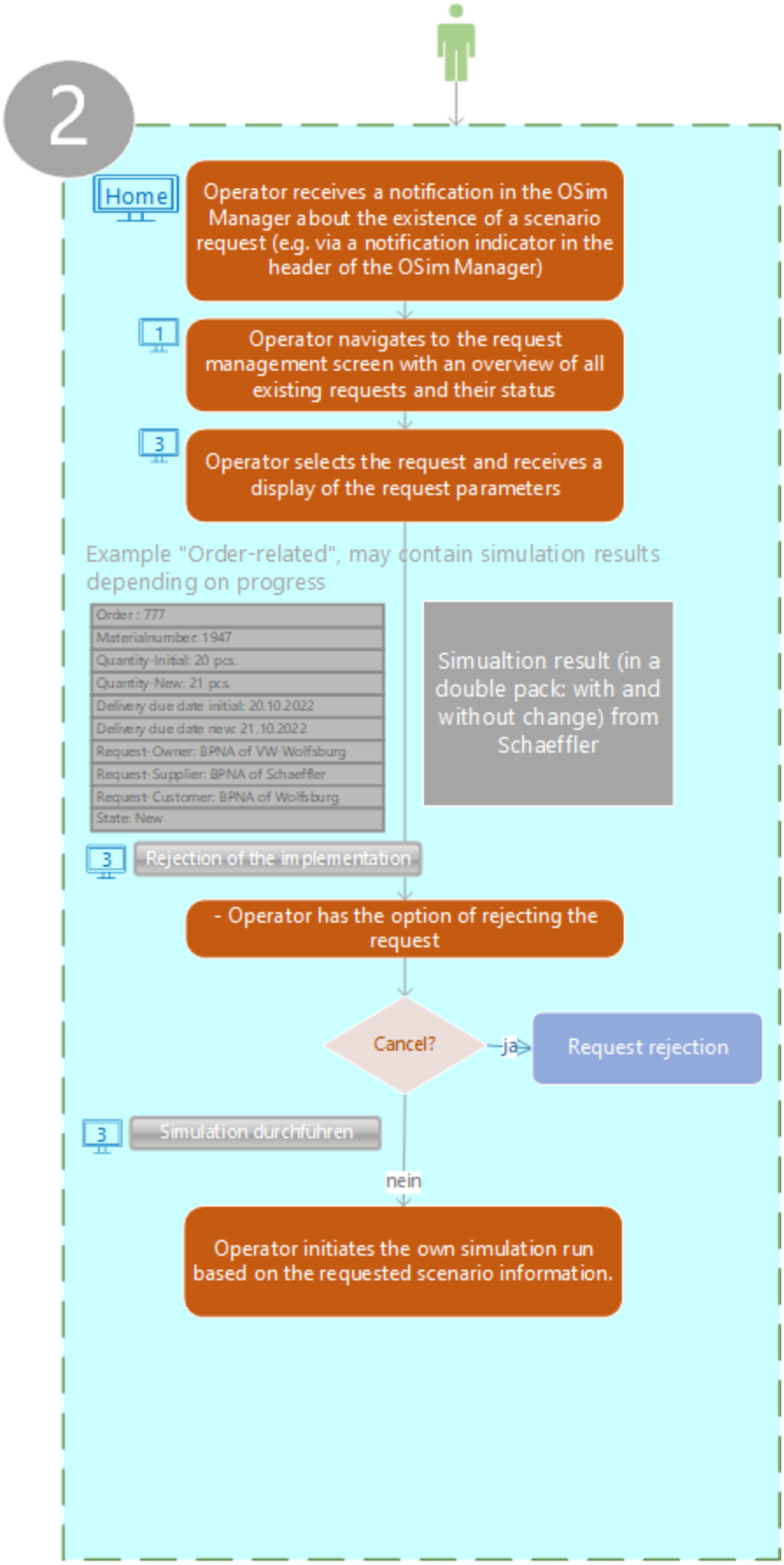
The second variant is about automatically considering the order-related parameters from the call in the simulation model, if possible. Here, too, a normal simulation has to be carried out first and then the one based on the adjusted parameters. Both results are written back to the OSim Manager in a double pack.

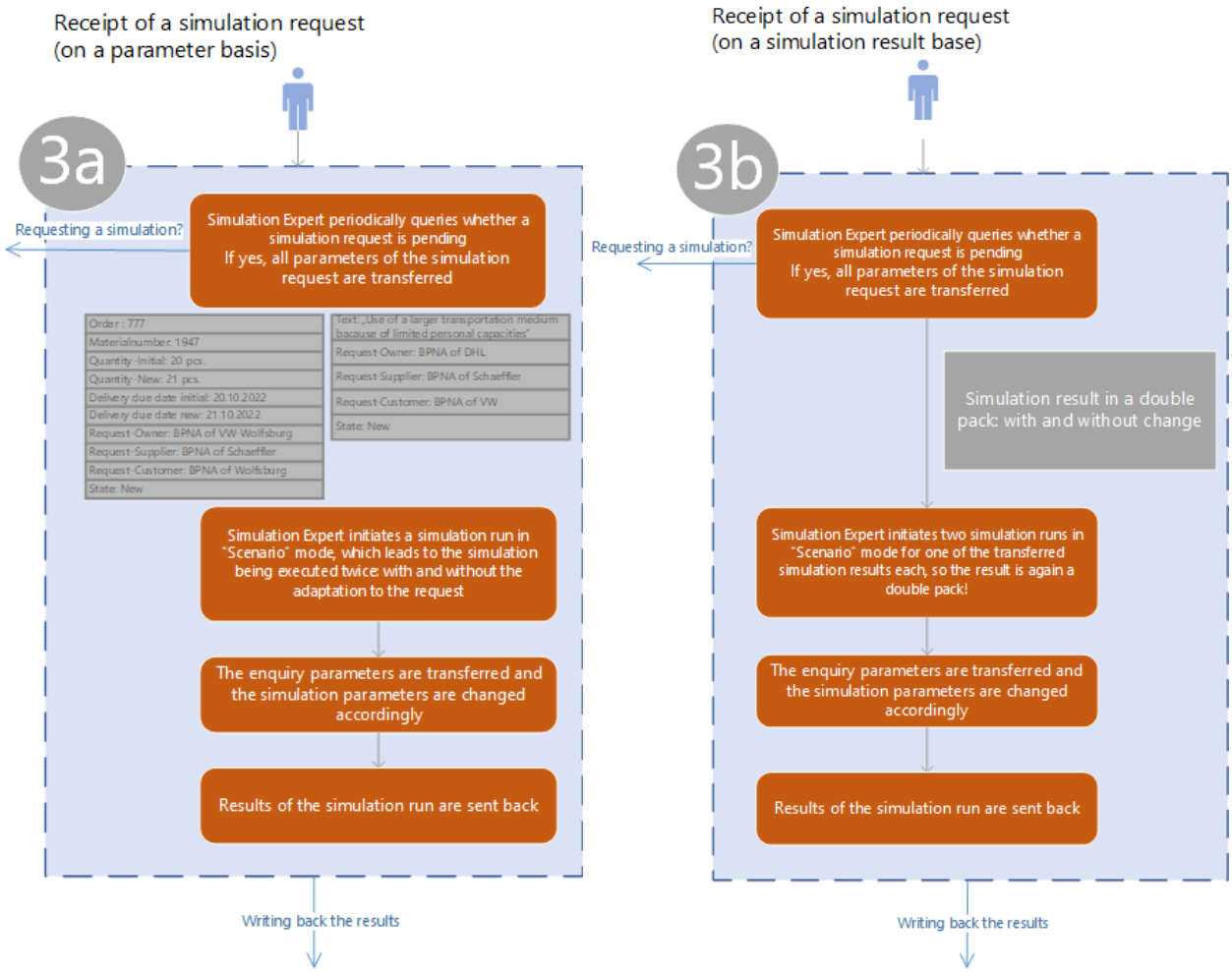
The third one on two different input parameter sets. This means that first a simulation run is done based on the first input parameter set. The second one - based on the second input parameter set. Both results are written back to the OSim Manager in a double pack.


Request initiation
1
Operator opens the request management screen
Operator creates a new request by:
1) Specifying "Who am I?" (customer, supplier, logistician2Left or logistician2Right)
2) Specifying the corresponding request recipients (1..n)
3) Specification of the parameter values for each supplier or customer (from a selection of parameter sets, such as order reference, free text, ...)
Example "Order-related" to two suppliers
Order : 777
Materialnumber: 1947
Quantity-Initial: 20 pcs.
Quantity-New: 21 pcs.
Delivery due date initial: 20.10.2022
Delivery due date new: 21.10.2022
Request-Owner: BPNA of VW-Wolfsburg
Request-Supplier: BPNA of Schaeffler
Request-Customer: BPNA of Wolfsburg
State: New
Order : 888
Materialnumber: 4711
Quantity-Initial: 20 pcs.
Quantity-New: 21 pcs.
Delivery due date initial: 20.10.2022
Delivery due date new: 21.10.2022
Request-Owner: BPNA of VW-Wolfsburg
Request-Supplier: BPNA pf ZF
Request-Customer: BPNA of Wolfsburg
State: New
Example „Free text"
"Consideration of using a larger transporter"
Special procedure:
→ Own simulation
→ Message to the predecessor by adjusting its result
→ Message to the successor: "normal" run
Text: „Use of a larger transportation medium because of limited personal capacities"
Request-Owner: BPNA of DHL
Request-Supplier: BPNA of Schaeffler
Request-Customer: BPNA of VW
State: New
Save
Am I the customer or logistician receeving in this scenario?
no
yes
Trigger your own simulation, as the simulation results must be added as transfer parameters
Triggers the request to the affected suppliers with a confirmation button
3a
2

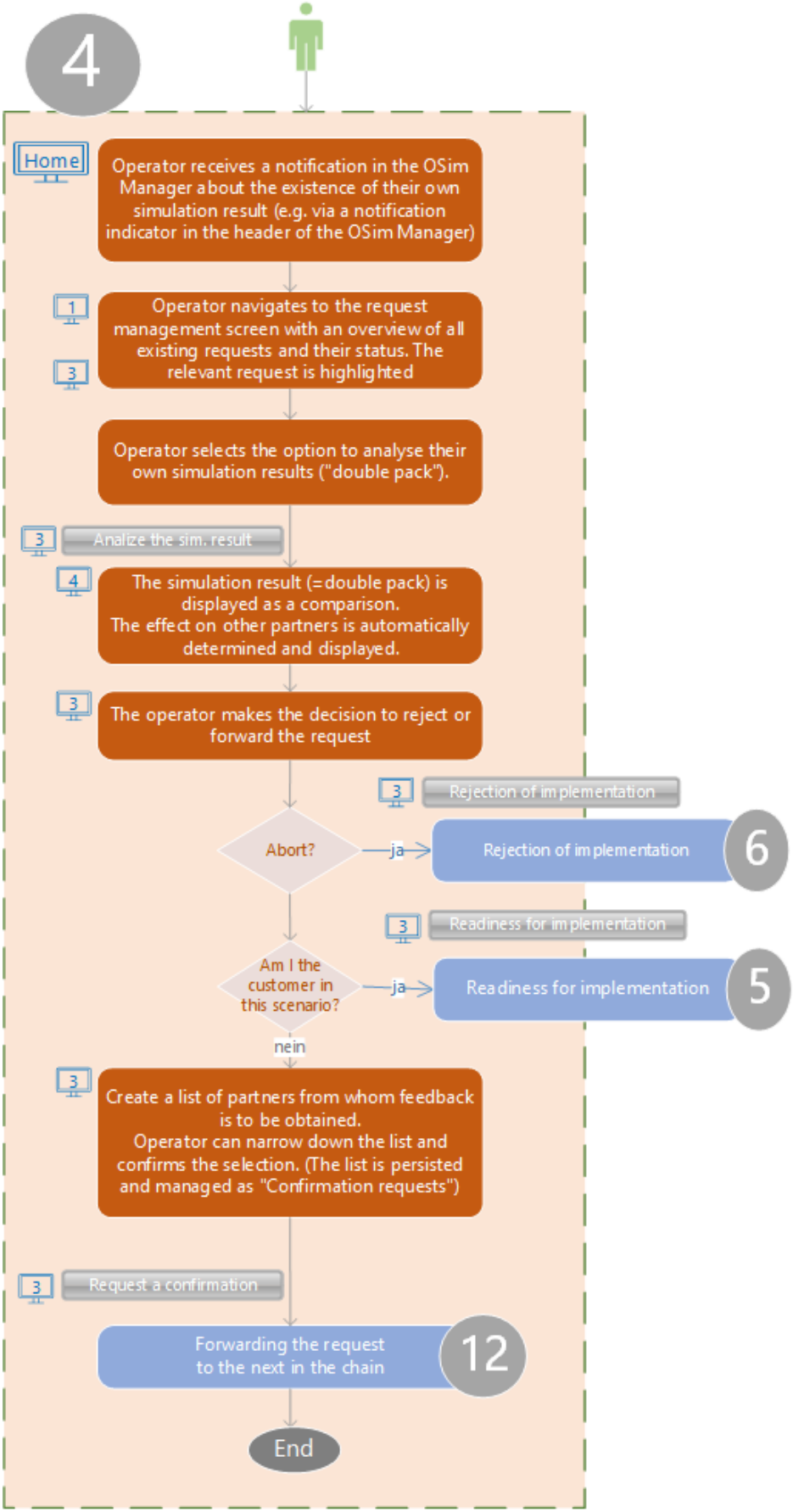
C
P

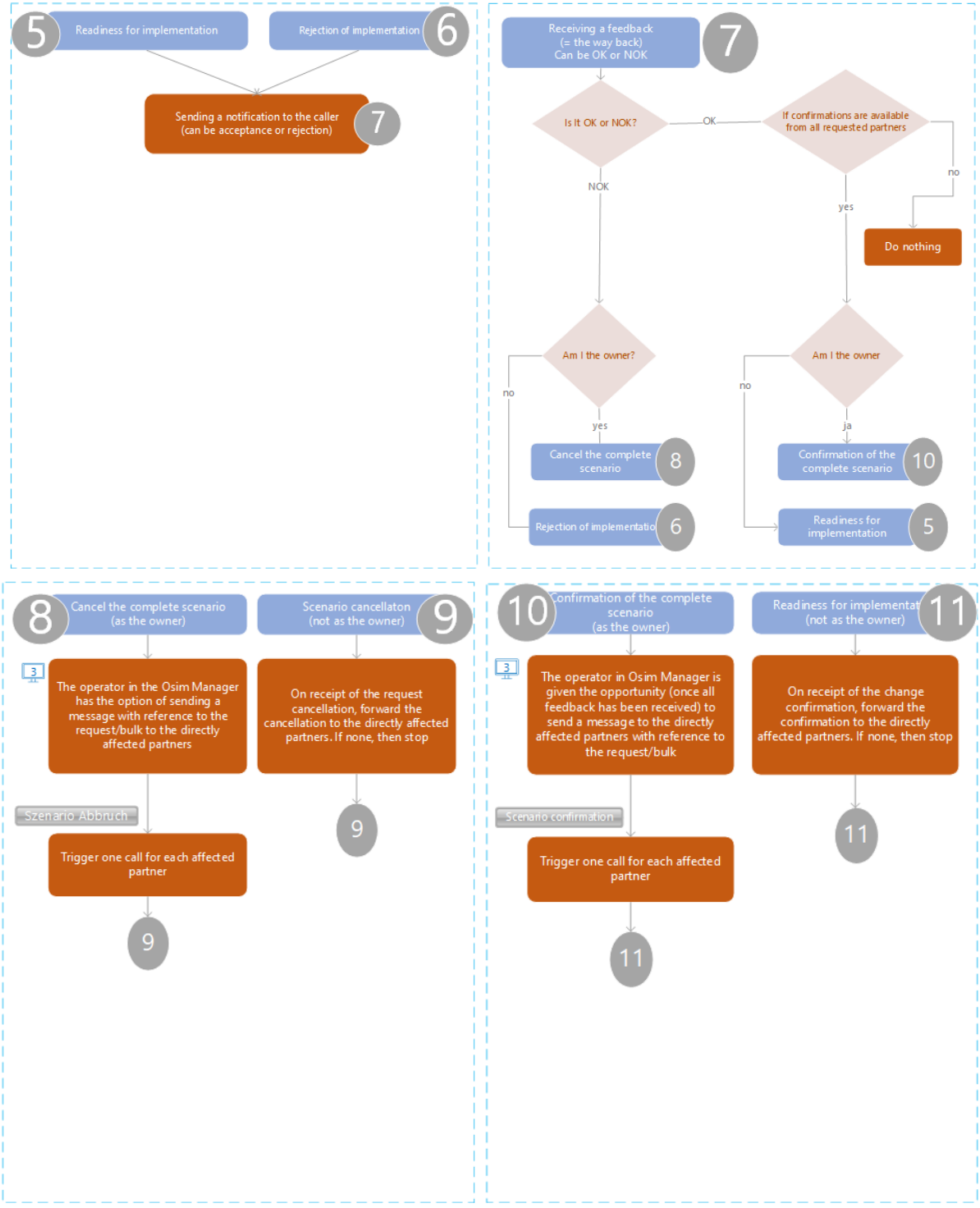
Receiving a request

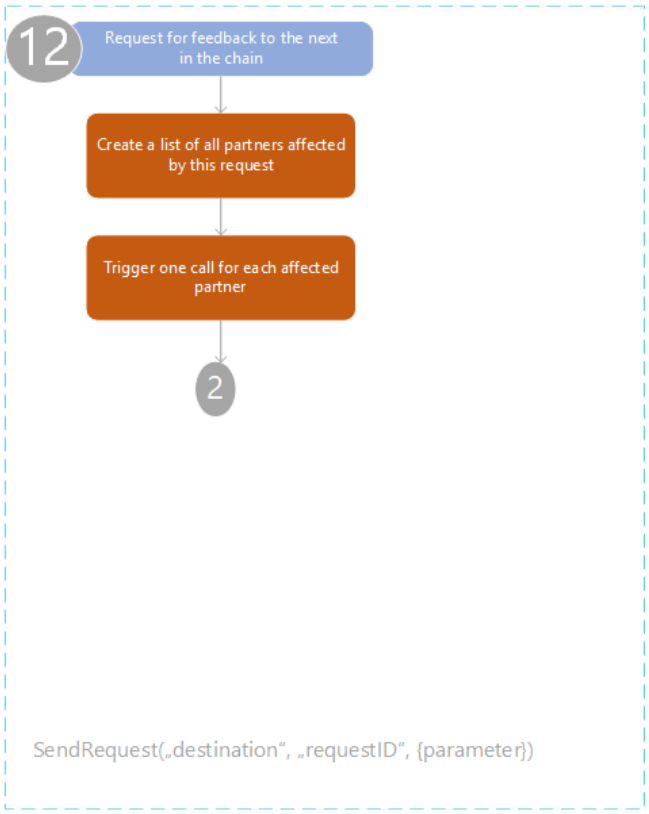



Receipt of a simulation request
(on a parameter basis)
3a
Requesting a simulation?
Simulation Expert periodically queries whether a simulation request is pending
If yes, all parameters of the simulation request are transferred
Order : 777
Materialnumber: 1947
Quantity-Initial: 20 pcs.
Quantity-New: 21 pcs.
Delivery due date initial: 20.10.2022
Delivery due date new: 21.10.2022
Request-Owner: BPNA of VW-Wolfsburg
Request-Supplier: BPNA of Schaeffler
Request-Customer: BPNA of Wolfsburg
State: New
Text: „Use of a larger transportation medium because of limited personal capacities"
Request-Owner: BPNA of DHL
Request-Supplier: BPNA of Schaeffler
Request-Customer: BPNA of VW
State: New
Simulation Expert initiates a simulation run in "Scenario" mode, which leads to the simulation being executed twice: with and without the adaptation to the request
The enquiry parameters are transferred and the simulation parameters are changed accordingly
Results of the simulation run are sent back
Writing back the results
Receipt of a simulation request
(on a simulation result base)
3b
Requesting a simulation?
Simulation Expert periodically queries whether a simulation request is pending
If yes, all parameters of the simulation request are transferred
Simulation result in a double pack: with and without change
Simulation Expert initiates two simulation runs in "Scenario" mode for one of the transferred simulation results each, so the result is again a double pack!
The enquiry parameters are transferred and the simulation parameters are changed accordingly
Results of the simulation run are sent back
Writing back the results

Receiving your own simulation result




5
Readiness for implementation
Rejection of implementation
6
Sending a notification to the caller (can be acceptance or rejection)
7
Receiving a feedback (= the way back) Can be OK or NOK
7
Is it OK or NOK?
OK
If confirmations are available from all requested partners
no
yes
Do nothing
NOK
Am I the owner?
no
yes
Cancel the complete scenario
8
Rejection of implementatio
6
Am I the owner
no
ja
Confirmation of the complete scenario
10
Readiness for implementation
5
8
Cancel the complete scenario (as the owner)
Scenario cancellaton (not as the owner)
9
The operator in the Osim Manager has the option of sending a message with reference to the request/bulk to the directly affected partners
On receipt of the request cancellation, forward the cancellation to the directly affected partners. If none, then stop
Szenario Abbruch
Trigger one call for each affected partner
9
9
10
Confirmation of the complete scenario (as the owner)
Readiness for implementat
(not as the owner)
11
The operator in Osim Manager is given the opportunity (once all feedback has been received) to send a message to the directly affected partners with reference to the request/bulk
On receipt of the change confirmation, forward the confirmation to the directly affected partners. If none, then stop
Scenario confirmation
Trigger one call for each affected partner
11
11


12
Request for feedback to the next in the chain
Create a list of all partners affected by this request
Trigger one call for each affected partner
2
SendRequest(„destination", „requestID", {parameter})

Scenario Manager

The Scenario Manager is a module of the OSim Manager and allows the user to interact with simulation scenarios and results.

The user can

- Initiate simulation scenarios
- view, compare and release simulation scenarios and results
- Send information on selected scenarios to supply chain partners
- Initiate simulation runs based on scenario-related result data from supply chain partners and disruptive events.

The following chapters describe the individual masks for managing scenarios.

First: Scenario List

This page provides an overview of all recorded scenario cases. These can be your own scenarios and those of the partners.

Scenario header information is displayed in tabular form and various actions are offered for each selected line. There is also an option to initiate a new scenario.

Functional Description

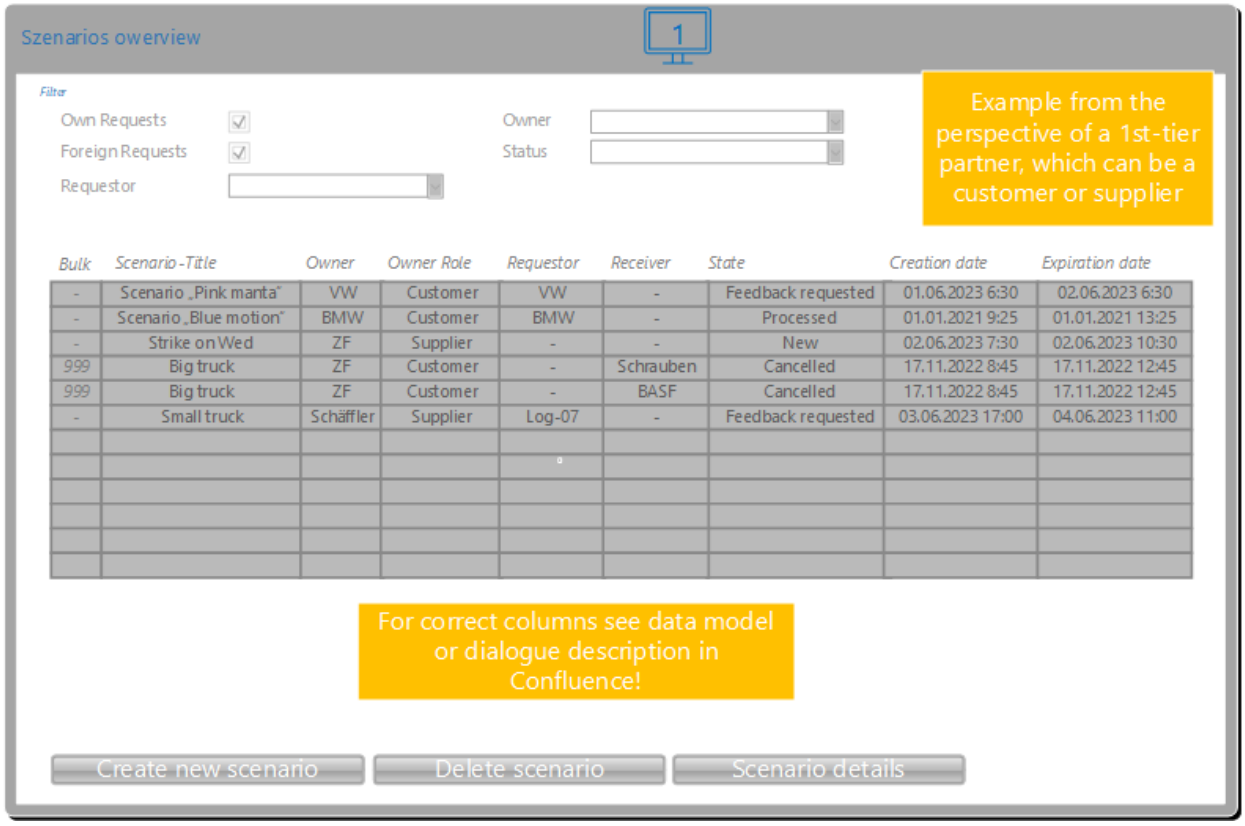
- Display of the following filter criteria:
  - Checkbox "Own requests"
  - Checkbox "Foreign requests"
  - Dropdown "Requestor"
  - Dropdown "Owner"
  - Dropdown "Status"
- Presentation of the scenario cases in tabular form:
  - Bulk Title (bulkTitle)
    - if no Bulk, then NULL
  - Scenario Title
  - Owner (scenario.Owner in text). PW: Will be implemented as "Legal entity name - Address name"
  - Owner role
  - Requestor (iterationPredecessor in text)
    - All iterationPredecessors of the current scenario comma separated
  - Receiver (feedbackFromAddress in text)
    - Only in case of bulk
    - Link over the initial iteration (predecessor = NULL)
  - State (scenarioState)
  - Creation date (scenarioCreated)

- Expiration date (scenarioExpirationTimestamp)

  Correct columns - see data model

- Button 'Scenario Details
- Button 'Create new scenario
- Button 'Delete Scenario': The selected scenario, if it has the status 'New', 'Canceled' will be removed from the database and will no longer be displayed in the Scenario Manager. Otherwise an error message will be shown.

Mockup:



Second: Scenario initiation

This page allows you to initiate a new scenario case.

Depending on the initiator role (customer/supplier/logistician), this can be done in 3 steps:

- Specify "who am I?". One of the following 3 roles can be selected: a) Customer, b) Supplier, c) Logistician. This determines the scenario progression.

- According to the initiator role, specify the request recipients (1..n).
  Attention: If your own simulation is still being carried out (case = "Initiator is logistician or supplier"), this list is entered after the simulation has been carried out, as only then will the degree of impact of the change become apparent.
- Specification of parameter values for each supplier or customer from a selection of parameters such as order reference, product, quantity, time and free text.

Functional Description

- "Initiate scenario 1/3"
  - Specify the title, expiration date and the role of the initiator: customer, supplier or logisticianReceiving, logisticianSending.
  - Button "Next" leads to "Initiate scenario 2/3" if "Customer" or "LogisticianReceiving" is selected, or directly to "Initiate scenario 3/3", depending on the specification.
  - Button "Cancel" leads back to the scenario case overview.

- "Initiate Scenario 2/3
  - Display of a list with all predecessors of the initiator with the possibility of multiple selection. The filtering of the predecessors depends on the selection of the role.
    - If "Customer" is selected: List of all production companies from the "PredecessorPairs" table.
    - If "LogisticianReceiving" is selected: List of all logistics companies, if available, otherwise production companies from the "PredecessorPairs" table.
  - If more than one predecessor was selected
    - we are in the case "Bulk". In this case a bulk object will be created (see below)
  - Button "Next" leads to "Initiate Scenario 3/3".
  - Button "Prev" leads to "Initiate scenario 1/3".
  - Button "Cancel" leads back to the scenario case overview. The scenario case is not saved

- "Initiate Scenario 3/3
  - In the case "Role=Customer/LogisticianReceiving", the parameters can be entered for each supplier. For this purpose, the list with the selection option of the suppliers selected in "Initiate scenario 2/3" is displayed.
    The selection of a supplier in the list determines the affiliation of the parameter block on the right of the mask and the free text.
    - Thus, more than one parameter sets can be entered for each supplier.
    - For each supplier, one new scenarioHeader is created.

  This creates several scenarios, which are combined in one bulk.

- Each parameter set is saved in a scenarioParameters object; several ones can be created per scenario.
- In the list with order-related attributes, such as order ID, material, quantity old and new, UOM, latest delivery time old and new, information can be entered that will accompany the scenario request and will be taken into account in the supplier simulation as automatically as possible. Here, the order data is only the desired changes and not all orders. In other words: In the case of an order-related scenario, the order ID must be specified, otherwise it is an additional delivery (analogous to a new delivery order).
  One and the same order can be entered several times. This would be the case if the original order contains several items and several of these items are to be adjusted.

- Before saving, the following validations are carried out:
  - Spezificaton of "material" is a must. Otherwise - error message.
  - Specification of "quantity old" only makes sense if the order is specified. Otherwise - error message.
  - Specification of "quantity new" is a must. Otherwise - error message.
  - Specification of "delivery date old" only makes sense if an order is specified. Otherwise - error message.
  - Specification of "delivery date new" is a must. Otherwise - error message.
- Alternatively, the scenario description can be entered as free text.

- Button "Save" leads to the initiation of the scenario. This means creating database entries in:
  - In case "Bulk" (see above)
    - 1 scenarioBulk
    - scenarioHeaders (one for each selected supplier): scenarioState ="New"
  - Else
    - 1 scenarioHeader: scenarioState ="New";
  - scenarioParameters (for each scenarioHeader according the number of parameter sets);
  - scenarioIterations (1x per each scenarioHeader): iterationState="New", iterationPredecessor = NULL;

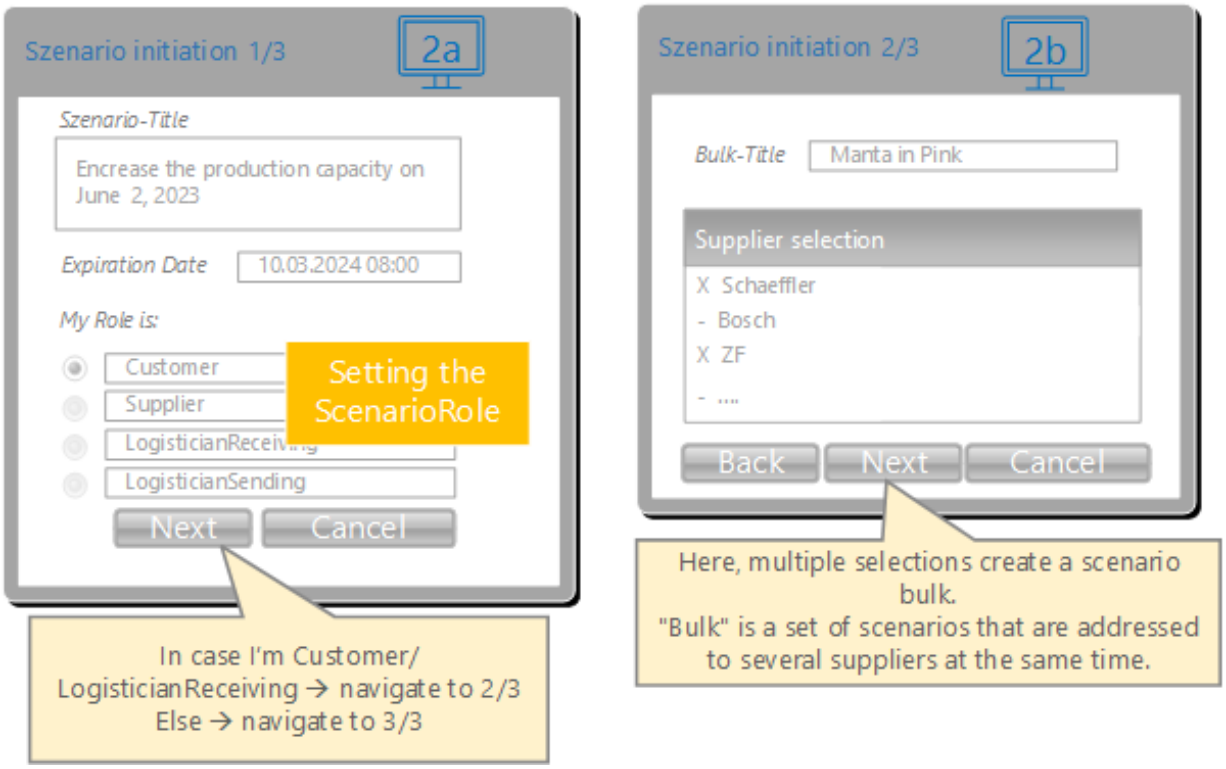
  - In case "Initiator is customer" or "Initiator is logisticianReceiving"
    - 1 scenarioFeedback per selected predecessor (PW: i.e. 1 scenarioFeedback per scenarioHeader) (to send the request for the feedback and capture the feedback result) : feedbackState="New", feedbackFromAddress="Selected supplier"
  - Else
    - no scenarioFeedback object, because at this time no dependency from partners is known;

Afterwards

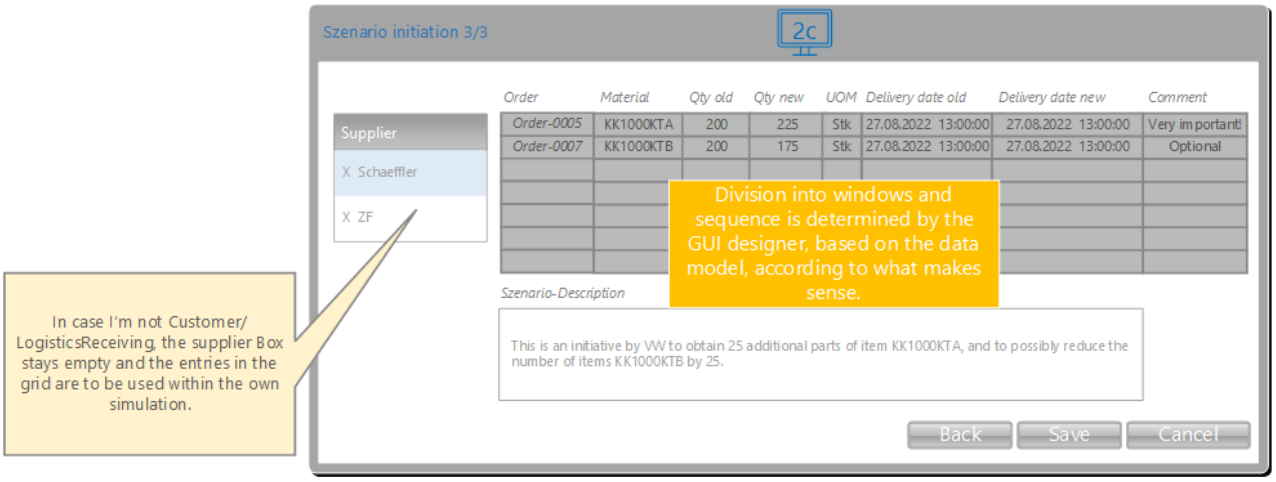
- In case "Initiator is customer" or "Initiator is *logisticianReceiving*"
  - For all scenarios (in bulk there are several, otherwise the one affected) set the status to "Feedback requested"
  - Set the status of all iterations (from all scenarios fals bulk) to "Feedback requested".
  - Set the status of all scenarioFeedbacks to "Feedback requested"
  - confirmation requests are sent to all selected suppliers. See the partner interface description in chapter Partner Interface and the method *requestScenarioFeedback*.
- otherwise
  - the own simulation is triggered with reference to the scenario just created. See the simulation interface description in chapter Simulation Interface.

- Button "Prev" leads to the previous step of the initiation.
- Button "Cancel" leads back to the scenario case overview. The scenario case is not saved

Mockup:



for the parameters UoM and material, offer a drop down menu with the entries present in the data model!



Third: Scenario details

This page allows a complete overview of the scenario parameters, to track the status of the scenario requests.

Depending on the status and origin of the scenario case, actions are offered to react to the scenario requests or to inform the partners as the owner of the scenario request about the implementation of the request. The following statuses are distinguished in this dialogue

- I am the initiator
  - I have just received my own simulation result and am distributing the requests for implementation readiness to the partners concerned
  - I have received some feedback, but not all, and am waiting for the last feedback to arrive
  - I have received all feedback Make my final decision on implementation
    - Scenario Implementation
    - Scenario Deletion
- I am a submitter of the request (can be supplier or logistics provider)
  - I have received a request for implementation readiness and trigger my own simulation
  - I have just received my own simulation result and am distributing the implementation readiness requests to the partners concerned
  - I have received some feedback, but not all and am waiting for the last feedback
  - I have received all feedback and give my feedback on readiness to implement to the requesting partner

Functional Description

- Display of the scenario header parameters
    - if possible: Requestor: predecessors of all iterations (BPNA name, carriage returns in between)
- "Input" tab:
    - Display Scenario parameters of the scenario and input simulation results of all iterations of the scenario.
        - Scenario Parameter Section: Fields analogous to scenario initiation.
        - Input simulation results Section: Following attributes of the SimulationRun to which SimulationRunUpdated points,
            - Owner, RunTimestamp and Description
            - Determine the data:
                - Read **all** iterations of the scenario (scenarioIterations). Read **all** external results for each iteration of the scenario (scenarioSimResultsInput). Read the data from the corresponding simulation run (simulationsRuns) from **all** external results found for the scenario updated result via the ID (resultInputSimRunUpdated).
        - Button "Analyse input" : leads to the display of the analysis/comparison mask of the simulation results
        - Button "Request own simulation" : leads to the request to run your own simulation. The scenario-related structure for recording the own simulation results is created in the Osim-Manager database. With this information, the operator can make the appropriate adjustments in the simulation model and carry out the simulation. For further information see chapter Simulations in Scenario Management context
          The following operations need to be performed:
            - Display a pop-up for entering the SimulationDescription.
            - Create a new entity scenarioSimResultsOwn.
            - Linking this entry to the corresponding scenarioIteration. This is the youngest (iterationCreaeDate) iteration of the current ScenarioHeader.
            - Create two new simulationRuns entries and link these to the scenarioSimResultOwn.*resultOwnSimRun**Initial*** and scenarioSimResultOwn.*resultOwnSimRun**Updated***
                - State: 10
                - description: out of the Popup
                - everything else analogously to the creation of a simulation stub in basic simulation

- "My results" tab:
    - Display "Own simulation result" : Only attributes on the simulation level (means no details of a simulation) are displayed.

- simulationRunTimestamp, simulationDescription, simulationComment, simulationStatus from simulationsRun Entity to all own, upated runs of all iterations of the current scenario.
    - Read **all** iterations of the scenario (scenarioIterations). Read the own results for **each** iteration of the scenario (scenarioSimResultsOwn). Read the data from the corresponding simulation run (simulationsRuns) from **all** own results found for the scenario updated result via the ID (resultOwnSimRunUpdated).
- In addition, the column "Considered Simulation Results from" lists the owners of the considered input simulation results. Composition:
    - For each SimulationResultOwn, there is an iteration (scenarioIterations).
    - Each iteration contains a predecessor (iterationPredecessor)
    - For each displayed SimulationResultOwn (scenarioSimResultsOwn) the predecessor of the corresponding iteration is displayed and additionally comma separated all predecessors of the older iterations (iterationCreateDate).

- Button "Import sim. result (Excel)" : performs the same preparatory function as "Run simulation" and additionally enables the Excel import of the simulation results. This enables the correct allocation of the results of the two simulation runs (properties "simulationRunInitial" and "simulationRunUpdated") in the database.
- Button "Analyse simulation result" button : leads to the display of the analysis/comparison mask of the simulation results.

- Display "Affected partners / feedback":
    - A list of affected partners is extracted from the simulation result just marked in the visualisation.
        - The logic for determining the affected partners is defined in the chapter Workflow for analysing of simulation results in regards to the affected partners.
    - In addition, a selection option is offered for each extracted partner in order to enable a selection of partners for requesting feedback. This column ("Selection") is always editable as long as the status of the affected iteration is "New".
    - Button "Request confirmation": The scenario is forwarded to the affected and selected partners. In the process, the data relevant to the recipients is read from the OSim Manger database and appended to the message.
        - Validation:
            - If my role in the scenario is "Customer", the so-called "end point" of the scenario has been reached. In this case, the button is deactivated. Your own role in the scenario must be determined using the network structure.
            - Confirmations can only be requested if

            - At least one partner is selected with "x" in the display and
            - if there is not yet another own simulation result in status 12 (=Selected) for the scenario.
        - Action:
            - Set the status of the current simulation result to 12 (Selected)
            - Create entries in ScenarioFeedback in "FeedbackRequested" status for each selected partner.
            - Set the status of all iterations of the scenario to "FeedbackRequested".
              (Note: The status of the first iteration of a "Customer" client or "LigisticianReceiving" is already in the status "FeedbackRequested". Means - no effect)
            - Set the status of the scenario to "FeedbackRequested".
            - Call the method requestScenarioFeedback per feedback with the corresponding FeedbackID.

    - Display "Feedback"
      A distinction is made between two cases:
        - Case A: There is only the initial iteration (predecessor=NULL), which is in the status "Feedback requested".
        - Case B: There are iterations other than the initial one that have the status "New" or "Feedback requested".

        - In case A, the list is filled with the feedback partners from the initial iteration.
        - In case B, the list is filled with the feedback partners from all iterations except the initial one.

    -
    - In addition, attributes of the confirmation requests are displayed for each extracted partner, if there are entries in the ScenarioFeedback:
        - "Timestamp of request"
        - "Timestamp of feedback
        - "State
        - "Feedback Comment

- Button "Ready for implementation" : leads to positive feedback on a confirmation request.
    - Activation possible if there is an iteration with the iterationPredecessor <> NULL in status "New" or "FeedbackRequested".
        - For each iteration with iterationPredecessor <> NULL
            - set the status of the iteration to "Realizable" and
            - call the method receiveScenarioFeedback with status "Realizable".

- Button "Reject implementation" : leads to negative feedback on a confirmation request
    - Actuation possible if there is an iteration with iterationPredecessor <> NULL in status "New" or "FeedbackRequested".
        - For each iteration with iterationPredecessor <> NULL
            - set the status of the iteration to "Realizable" and
            - call the method receiveScenarioFeedback with status "Not Realizable".

- In case "I am the scenario owner"

    - Button "Scenario Confirmation"
        - Case "no bulk"
            - Activation possible if the initial iteration, means iterationPredecessor = NULL, is in the status "Realizable".
            - Action: Notification of the affected partners about the initiator's positive decision to implement the scenario.
                - The status of the scenario is set to "In Realisation".
                - Enter a comment on the further procedure with the new scenario status.
                  (Note: The current version of the partner interface doesn't allow the transmission of this comment.)
                - Calling the method pushScenarioState with status "In Realisation for each previously requested partner.

        - Case "Bulk
            - Actuation possible if the initial iteration, means iterationPredecessor = NULL, is in the "Realizable" state.
              Note: If there are other scenarios in the status not equal to WaitForBulkCompleted apart from the current scenario, the confirmation is not sent directly, but receives a corresponding status "WaitForBulkCompleted".
                - The status of the scenario is set to "WaitForBulkCompleted".

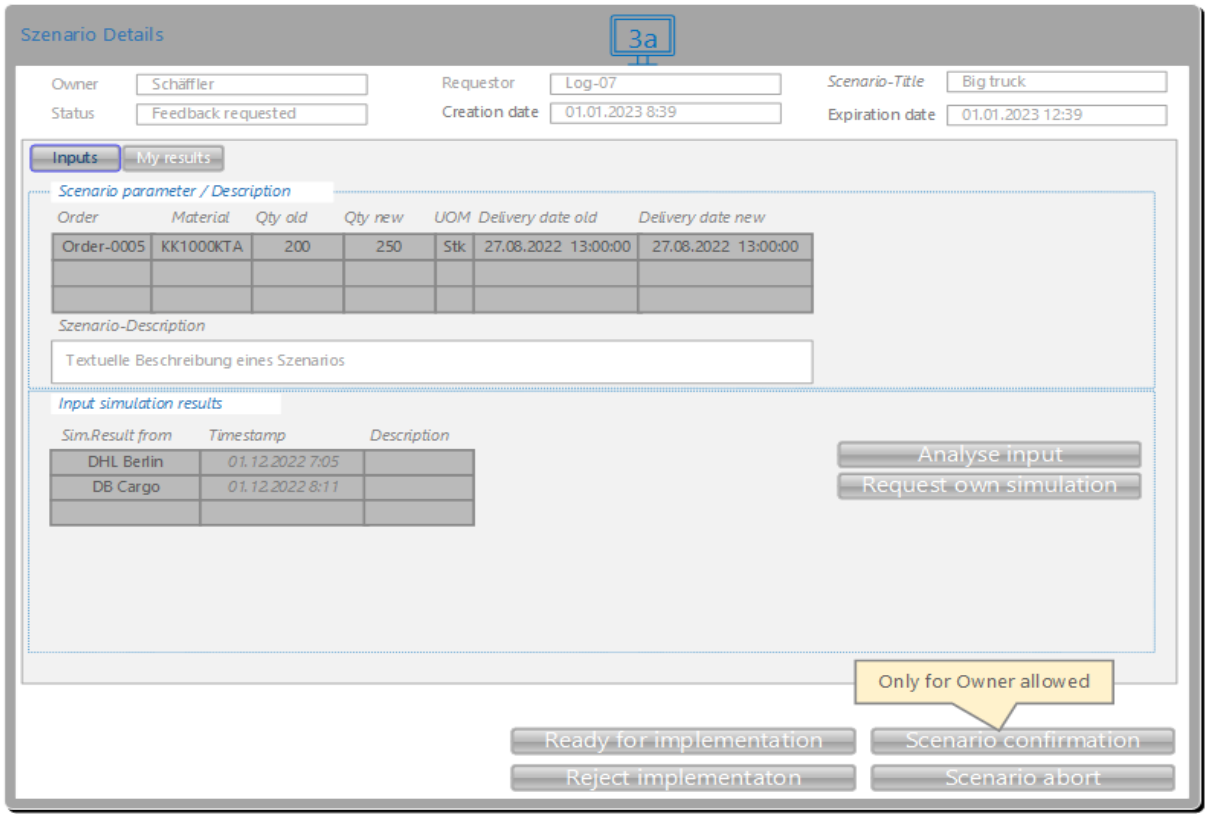
                - If the last scenario of the bulk is confirmed?
                    - The user will be informed via a pop-up that all affected partners of the scenarios of the bulk will now be informed.
                    - The status of the scenario is set to "In Realisation".
                    - Enter a comment on the further procedure with the new scenario state.
                      (Note: The current version of the partner interface doesn't allow the transmission of this comment.)

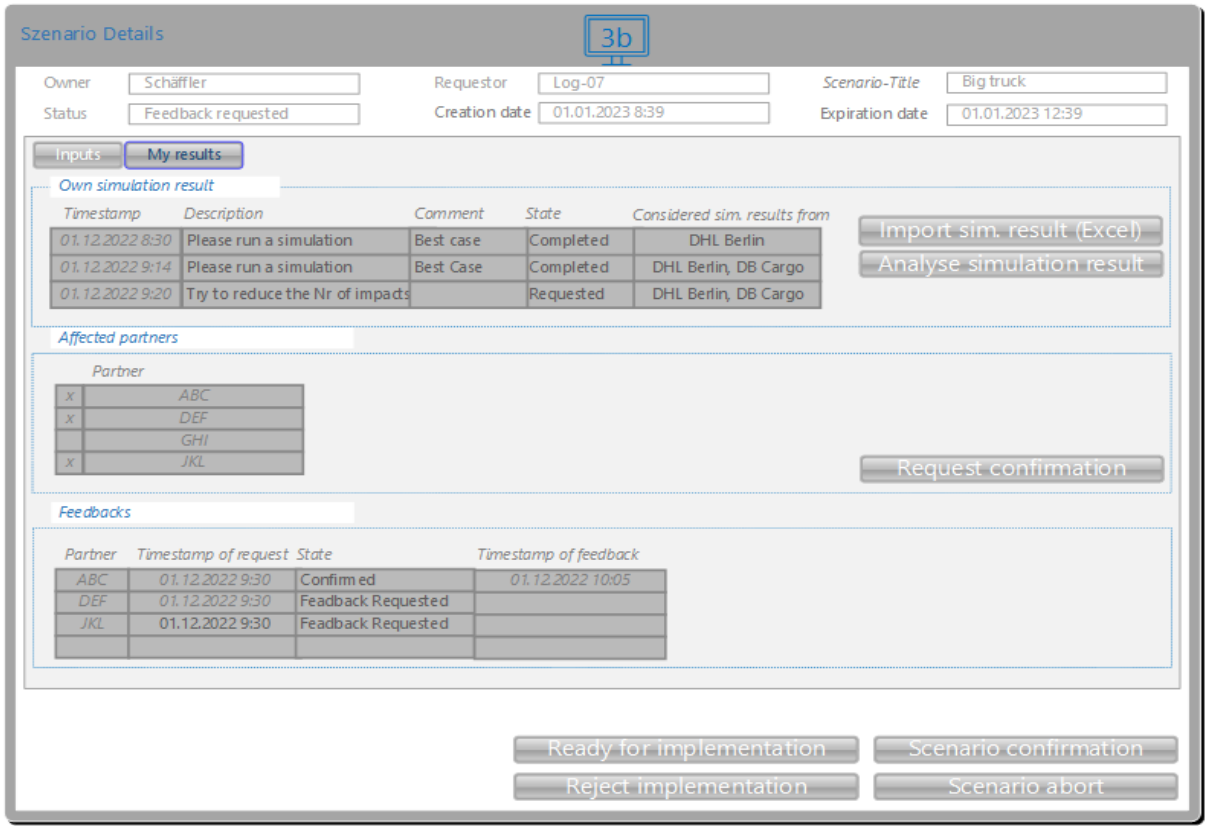
            - Calling the method pushScenarioState with status "In Realization" for each previously requested partner of all scenarios of the bulk.
        - Else : The user is informed via a pop-up that the bulk is not yet completed.

- Button "Scenario abort"
    - Case "no bulk" :
        - Activation is only possible if the initial iteration with iterationPredecessor = NULL is in the status "Realizable" or "Not Realizable".
        - Termination of the scenario and sending of corresponding notifications to the previously requested partners (persisted in scenarioFeedback). There is an option to enter a comment on the new scenario status and confirm the status change.
            - The status of the scenario is set to "Canceled".
            - Entering a comment on the further procedure with the new scenario state.
              (Note: The current version of the partner interface doesn't allow the transmission of this comment.)
            - Calling the method pushScenarioState with status "Canceled" for each previously requested partner.

    - Case "Bulk" :
        - Activation possible if the initial iteration with iterationPredecessor = NULL is in the status "Realizable" or "Not Realizable".
        - If the currently displayed scenario is part of a bulk, the abort notification is immediately sent to all requested partners. It is possible to enter a comment on the new scenario status and confirm the status change.
            - The status of all scenarios of the bulk is set to "Canceled".
            - Entering a comment on the further procedure with the new scenario state.
              (Note: The current version of the partner interface doesn't allow the transmission of this comment.)
            - Calling the method pushScenarioState with status "Canceled" for each previously requested partner of all scenarios of the bulk.

Mockup with two TABs: "Inputs" and "My results"


Szenario Details
3a
Owner
Schäffler
Requestor
Log-07
Scenario-Title
Big truck
Status
Feedback requested
Creation date
01.01.2023 8:39
Expiration date
01.01.2023 12:39
Inputs
My results
Scenario parameter / Description
Order
Material
Qty old
Qty new
UOM
Delivery date old
Delivery date new
Order-0005
KK1000KTA
200
250
Stk
27.08.2022 13:00:00
27.08.2022 13:00:00
Szenario-Description
Textuelle Beschreibung eines Szenarios
Input simulation results
Sim.Result from
Timestamp
Description
DHL Berlin
01.12.2022 7:05
DB Cargo
01.12.2022 8:11
Analyse input
Request own simulation
Only for Owner allowed
Ready for implementation
Scenario confirmation
Reject implementaton
Scenario abort


Szenario Details
3b
Owner
Schäffler
Requestor
Log-07
Scenario-Title
Big truck
Status
Feedback requested
Creation date
01.01.2023 8:39
Expiration date
01.01.2023 12:39
Inputs
My results
Own simulation result
Timestamp
Description
Comment
State
Considered sim. results from
01.12.2022 8:30
Please run a simulation
Best case
Completed
DHL Berlin
01.12.2022 9:14
Please run a simulation
Best Case
Completed
DHL Berlin, DB Cargo
01.12.2022 9:20
Try to reduce the Nr of impacts
Requested
DHL Berlin, DB Cargo
Import sim. result (Excel)
Analyse simulation result
Affected partners
Partner
ABC
DEF
GHI
JKL
Request confirmation
Feedbacks
Partner
Timestamp of request
State
Timestamp of feedback
ABC
01.12.2022 9:30
Confirmed
01.12.2022 10:05
DEF
01.12.2022 9:30
Feadback Requested
JKL
01.12.2022 9:30
Feadback Requested
Ready for implementation
Scenario confirmation
Reject implementation
Scenario abort

Workflow for analysing of simulation results in regards to the affected partners

In the course of scenario management, own simulation results are generated as a double pack. By comparing the two simulation runs ("initial" and "updated"), it can be determined which partners are affected by the simulation result.

This workflow describes the procedure for determining the list of affected partners.

Workflow and Details

In general, there are various test characteristics that make the difference between the initial and adjusted simulation results. If one tries to divide these into groups, the following areas emerge:

- Order
- Shipment
- Handling Unit
- Material

As a basis for carrying out the result analysis, a view is created for each of the two simulation results, which contains the following information:

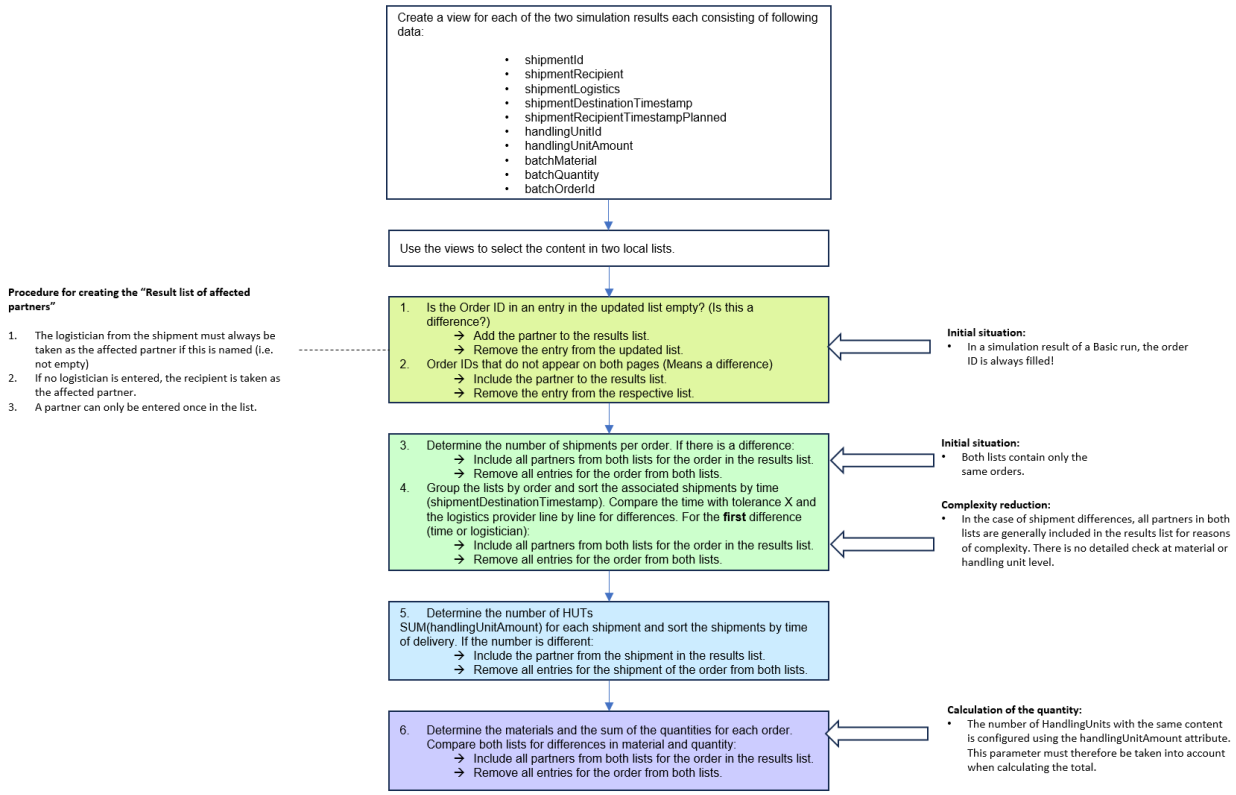
- shipmentId
- shipmentRecipient
- shipmentLogistics
- shipmentDestinationTimestamp
- shipmentRecipientTimestampPlanned
- handlingUnitId
- handlingUnitAmount
- batchMaterial
- batchQuantity
- batchOrderId

The principle of the analysis rests on the parallel comparison of the two views according to the following criteria:

- to the order
    - Check (#1) for shipments without order number.
      Example: For new material requests for which there is not yet an order number
    - Check (#2) whether the same order numbers are present in both views.
      Example: Order is not produced due to a scenario
- for the shipment

- Check (#3) whether the number of shipments per order is the same.
  Example: For one order there is a different number of shipments
- Check (#4) for equality of the time of delivery, taking into account a configurable tolerance in minutes and logisticians.
  Example: Shifting the delivery time or logistics company

- for the handling unit
  - Check (#5) for equality of the number of handling units per shipment in the order
    Example: For one order there is a different number of deliveries
- for the material
  - Check (#6) for equality of materials and their quantities per order
    Example: There are different materials or different delivery quantities for an order.



Fourth: Analyze simulation results

This page enables an analysis of a simulation result that has arisen due to a scenario request. For this purpose, the differences are identified and visualised by means of a multi-stage comparison

of the two simulation results, "initial" and "updated". The display is carried out in fixed steps analogous to the identification workflow:

1. Order related
2. Shipment related
3. HUT related
4. Material related

Attention: The step-by-step procedure with a fixed sequence of checks leads to the exclusion of the affected elements from the simulation result considered when a difference is detected, so that only the remaining elements are considered in the next check. Thus, it can happen, for example, that up to the last check there are no more entries in the remaining result list. Accordingly, the material-related display would remain empty.

Functional Description

- Display of the scenario header parameters (see also data model)
  - Simulation
    - Simulation owner
    - Date of simulation
  - Scenario
    - Scenario owner
    - Date of initiation
- Display of the directly affected partners in the network (as a list)
- Button "Simulation results initial" : displays the shipments of the "initial" simulation run.
- Button "Simulation results initial" : shows the shipments of the "updated" simulation run.
- Display of the following 4 tabs, which simultaneously represent the sequence of the analysis steps:
  - Order related
  - Shipment related
  - HUT related
  - Material related

Tab "Order related" : The display is differentiated in 3 modes, which are switched by means of the respective radio buttons:

- "Without order relation"
  - All entries from the analysis view (see the description of the sub-analysis, link) are displayed for the "updated" result, which have no order relation.
- "New orders"
  - All entries from the analysis view (see the description of the difference analysis, link) are displayed for the "updated" result, which refer to orders that do not appear in the "initial" result.
- "Excluded orders"

    - All entries from the analysis view (see the description of the sub-analysis, link) for the "initial" result are displayed that refer to orders that do not appear in the "updated" result.

Tab "Shipment related"

- "Different number of shipments per order"
    - All entries from the analysis view are displayed for the "updated" and "initial" result (see the description of the difference analysis, link) for each order if there is a different number of shipments for an order.
- "Different delivery timestamp"
    - All entries from the analysis view are displayed for the "updated" and "initial" result (see the description of the difference analysis, link) for each order if there are shipments with a different delivery date for an order.
- "Different logistician"
    - All entries from the analysis view are displayed for the "updated" and "initial" result (see the description of the difference analysis, link) for each order if there are shipments with a different logistician for an order.

Tab "HUT related"

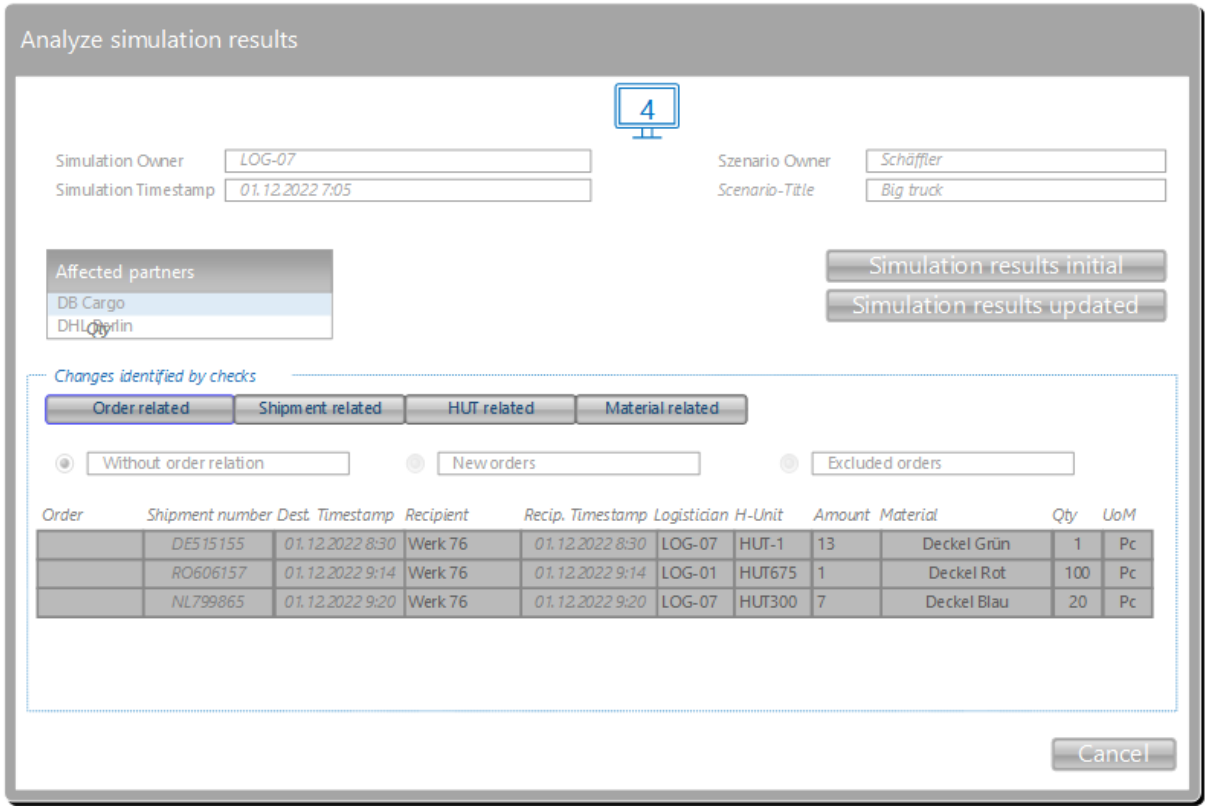
- Different number of handling units per shipment"
    - All entries from the analysis view are displayed for the "updated" and "initial" result (see the description of the difference analysis, link) for each order and shipment where the number of handling units is different.

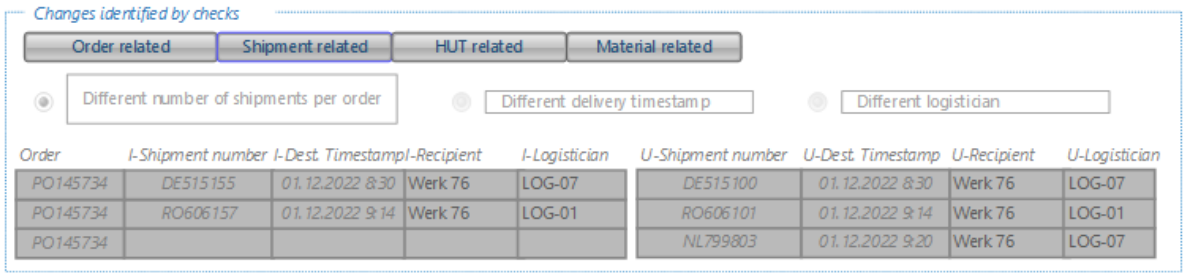
Tab "Material related"

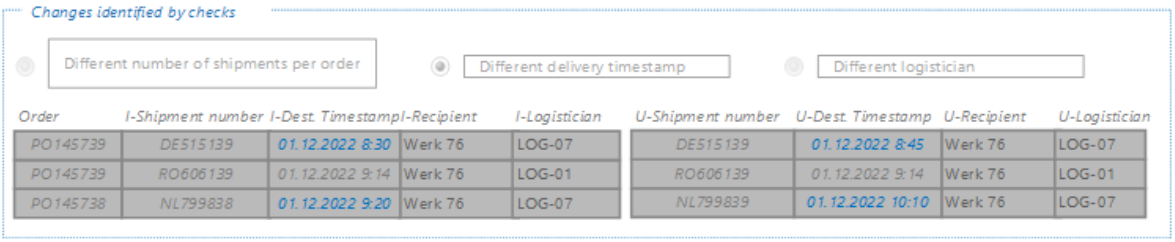
- "Additional material"
    - All entries from the analysis view for the "updated" result (see the description of the difference analysis, link) that are additional material (compared to the "initial" result) are displayed.
- "Excluded material"
    - All entries from the analysis view for the "initial" result (see the description of the difference analysis, link) are displayed that are material that is not present in the "updated" result.
- "Different quantity of material"
    - All entries from the analysis view for the "updated" and "initial" result (see the description of the difference analysis, link) are displayed for each material where the material quantity is different.

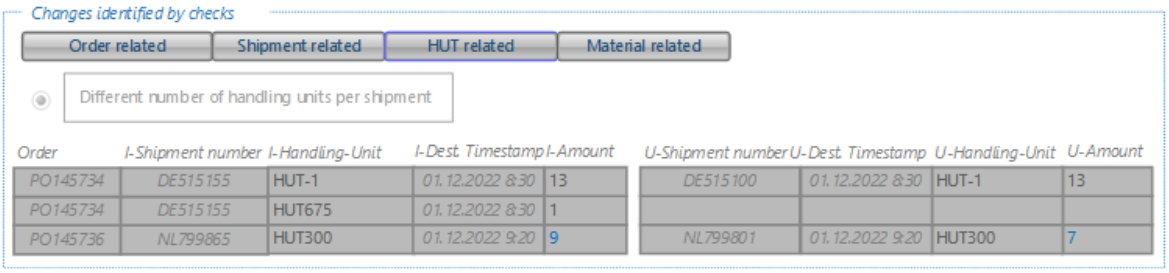
- Button "Back" : leads to the calling mask

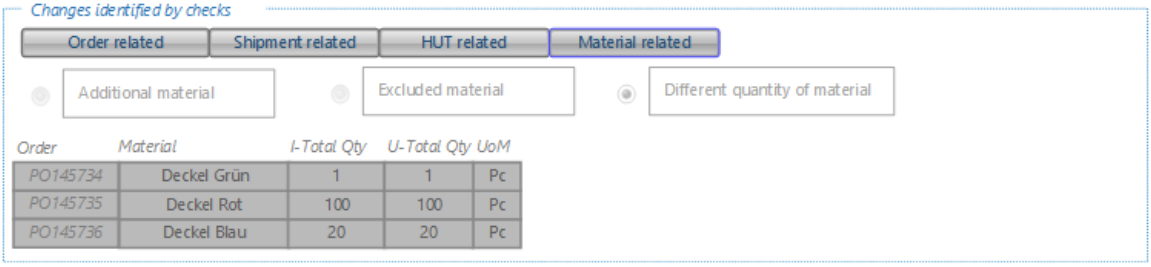
Mockup:


Analyze simulation results
4
Simulation Owner
LOG-07
Simulation Timestamp
01.12.2022 7:05
Szenario Owner
Schäffler
Scenario-Title
Big truck
Affected partners
DB Cargo
DHL Berlin
Simulation results initial
Simulation results updated
Changes identified by checks
Order related
Shipment related
HUT related
Material related
Without order relation
New orders
Excluded orders
Order
Shipment number
Dest. Timestamp
Recipient
Recip. Timestamp
Logistician
H-Unit
Amount
Material
Qty
UoM
DE515155
01.12.2022 8:30
Werk 76
01.12.2022 8:30
LOG-07
HUT-1
13
Deckel Grün
1
Pc
RO606157
01.12.2022 9:14
Werk 76
01.12.2022 9:14
LOG-01
HUT675
1
Deckel Rot
100
Pc
NL799865
01.12.2022 9:20
Werk 76
01.12.2022 9:20
LOG-07
HUT300
7
Deckel Blau
20
Pc
Cancel


Changes identified by checks
Order related
Shipment related
HUT related
Material related
Different number of shipments per order
Different delivery timestamp
Different logistician
Order
I-Shipment number
I-Dest. Timestamp
I-Recipient
I-Logistician
U-Shipment number
U-Dest. Timestamp
U-Recipient
U-Logistician
PO145734
DE515155
01.12.2022 8:30
Werk 76
LOG-07
DE515100
01.12.2022 8:30
Werk 76
LOG-07
PO145734
RO606157
01.12.2022 9:14
Werk 76
LOG-01
RO606101
01.12.2022 9:14
Werk 76
LOG-01
PO145734
NL799803
01.12.2022 9:20
Werk 76
LOG-07


Changes identified by checks
Different number of shipments per order
Different delivery timestamp
Different logistician
Order
I-Shipment number
I-Dest. Timestamp
I-Recipient
I-Logistician
U-Shipment number
U-Dest. Timestamp
U-Recipient
U-Logistician
PO145739
DE515139
01.12.2022 8:30
Werk 76
LOG-07
DE515139
01.12.2022 8:45
Werk 76
LOG-07
PO145739
RO606139
01.12.2022 9:14
Werk 76
LOG-01
RO606139
01.12.2022 9:14
Werk 76
LOG-01
PO145738
NL799838
01.12.2022 9:20
Werk 76
LOG-07
NL799839
01.12.2022 10:10
Werk 76
LOG-07





Optional extentions

Collaboration function

The "Collaboration" functionality offers OSim users the option of exchanging messages with partners in the OSim network and in the global Catena-X network.

This provides the typical functions of a messaging system in the OSim Manager, e.g:

- Display of message lists
- Options for sorting and prioritising messages
- Searching messages by all attributes of the message structure and by free text
- Display of message texts
- Acknowledge or reply to messages
- Create and send messages
- Archiving and deleting messages

In addition to the message text, the individual messages contain a set of meta information that is automatically filled in and transferred from the OSim network configuration. This enables identification and allocation. For example, this would be information about the sender, recipient and the corresponding business partner numbers.

Messages exchanged with partners can either be written freely or generated based on modules/templates. The advantage of module-based messages is primarily the time saving and the option of dynamically filling in any placeholders with the correct values. For example:

- Request for a simulation update
- Notification that the sender has updated their simulation

Event Management

For short-term and operational planning, it may be necessary to be able to react adequately to a variety of internal and external events. This is why such events are analysed as part of event management. Planners and decision-makers should be supported by integrated and automated event monitoring in the manual and (semi-)automated interpretation of such events.

Possible Realisation

The disruption categories that are relevant for the supply chain under consideration are selected from a comprehensive disruption catalogue (see chapter Disturbance values). Within this category, different characteristics can be selected to be monitored (e.g. wars or changes in legislation as characteristics of geopolitical risks).

To obtain data on possible faults, data sources must be checked for the following criteria:

- General availability of the data,
- accessibility and design of the interface,
- timeliness,
- reliability and accuracy as well as
- costs for data procurement.

Suitable views must be created to visualise the disruptions. If the disturbance variables are geographically dependent (e.g. traffic jams or earthquakes), visualisation on a map depending on the node under consideration in the Catena-X network and its geocoordinates is recommended. This provides users with a quick and easy-to-understand overview for identifying relevant disturbance variables. To enrich this information and to analyse the disturbance variables in more detail, tables can be displayed in addition to the map, which contain further relevant information for decision-makers. Another view is suitable for visualising geographically independent disturbance variables (such as financial data), which displays this data in tabular form or in another suitable format. With the help of appropriate filters, users should be able to personalise their own view and adapt it to specific needs.

Due to the complexity of the mechanisms of action and higher-order effects, the faults are assessed manually by the respective users based on their experience or based on the use of other external assistance systems.

Concept of an evaluation logic for events with a connection to scenario management

The underlying process chain of the implemented event manager prototype is currently partially automated. When the location is entered, the display of events is automated; the evaluation of the event and the derivation of any suitable measures is carried out manually by the event management user. Accordingly, the user must independently check whether a visualised event affects and disrupts their own supply chain.

At a conceptual level, however, the extent to which events can be evaluated in order to achieve a higher degree of automation and how this can be linked to the scenario manager was considered. With the help of the evaluation of an event, a recommendation should be made on the initiation of a scenario request and its urgency or priority.

Firstly, it must be clarified whether an event under consideration has already had an impact and direct action is required, or whether there are only potential effects. In the first case, the scenario manager is outside the observation horizon and direct measures should be used to control the supply chain. In the second case, it is a scenario that can be analysed with the help of the scenario manager. The following parameters are highly relevant for evaluating events:

- Probability of occurrence (low to high),
- Extent (low to high),
- Type of impact (indirect vs. immediate),
- Location of the impact (internal vs. external) and
- change in the order parameters (permanent vs. temporary).

Other possible parameters that can lead to a refinement of the results:

- Methodology used to calculate the probability of occurrence
- Methodology used to calculate the extent

This collection is only listed as an example and can be expanded as required.

These parameter combinations can be modelled using a decision tree, for example. The expected severity of the event can be measured by standardising the parameters on a scale from 0 to 1 and additionally weighting the individual parameters. Machine learning methods that adjust the weights according to the actual impact of an event would also be conceivable here.

The risk tolerance can be realised either by the developer or by the user by setting specific limit values. It is advisable to translate these limit values from a quantitative to a qualitative evaluation system, e.g. using a traffic light system.

Depending on the evaluation, a recommendation can be made to trigger a scenario request and its urgency or priority, thus realising a (partially) automated pipeline from identified events to the triggering of scenario requests.

Disturbance values

In this context, disturbance values are defined as events that can have a negative impact on the functioning of a supply chain.

General description of disturbance variables

They can be described using different categories and a variety of possible characteristics. A possible selection of categories of disturbance variables and their characteristics are listed in the following table:

Category	Expression
Geopolitical developments	War, insecure energy and media supply, changes in import and export regulations, delays at borders, changes in certification requirements or standards
Labour strikes	Transport service provider strikes, public service strikes
Bottlenecks in transport infrastructure / transport	Congestion Transport infrastructure, bottlenecks Transport infrastructure Handling, bottlenecks Transport infrastructure Storage, accident Means of transport, shortage of critical components, shortage of loading aids (e.g. pallets), shortage of means of transport, theft / destruction, piracy
Organisational changes	Change in subcontracting / outsourcing / insourcing, Changed contractual conditions
force majeure / natural disasters	Disasters, storms, pandemics, terrorism
Finance / Capital markets	Shortage/increasing price of materials/materials, players with greater market power (quantity/price), currency fluctuations, corruption
Internal reasons for disruption	Failure of qualified personnel, Incorrect machine configuration, Machine failure, Missing tools, Faulty tools, Faulty tooling/equipment, Missing raw materials, Missing raw/auxiliary/operating materials, Missing semi-finished products, Missing finished products, Faulty raw materials, Faulty raw/auxiliary/operating materials, Faulty semi-finished products, Faulty/incorrect material provision, Faulty material flow technology, Faulty energy provision for MFT, Faulty energy provision for machines/plants, Faulty information provision for MFT, Faulty information provision for machines/plants, Faulty machine operation, Faulty assembly/incorrect installation, Faulty assembly/left/right, Deviation from plan Activity description/handling, Deviation from plan Processing time target (e.g. RampUp, learning (e.g. ramp-up, teach-in), Missing / fully utilised buffer positions, Missing / fully utilised processing positions, Technical wear and tear of equipment, Inconsistent information flow / missing trigger, Sequence error / incorrect material provision, Incorrect automation solutions / programme errors, Loading/unloading damage

In addition, there are a number of other characteristics that can be used to classify different types of disturbance variables:

Characteristic	Values
Relevance	Relevant, not relevant
Extent	neutral, weak, strong
Place of occurrence	Incoming goods, interim storage, material supply and disposal, outgoing goods
Process steps in automotive assembly	Vorfertigung, Lackierung, Vormontage, Endmontage, Qualitätskontrolle

In-/Outbound	Global suppliers (international), Regional supply chains (Europe), Local suppliers (Germany), Last mile (Germany)
Higher forces	Nature, state, market
according to the Ishikawa diagram	Man, machine, material, management, method, measurability, environment/ milieu
Operational functional areas	Provision, condition, location
Statistical significance	Random, Systematic

Analytics Add-Ons

Data analysis functions enhance the user experience of the OSim Manager. As is usual with software products, the collection of usage statistics, for example, can help to identify potential for improvement and set priorities in software development In addition, there are various options for extending the functional scope of the OSim Manager with data-based add-ons, thus offering users direct added value.

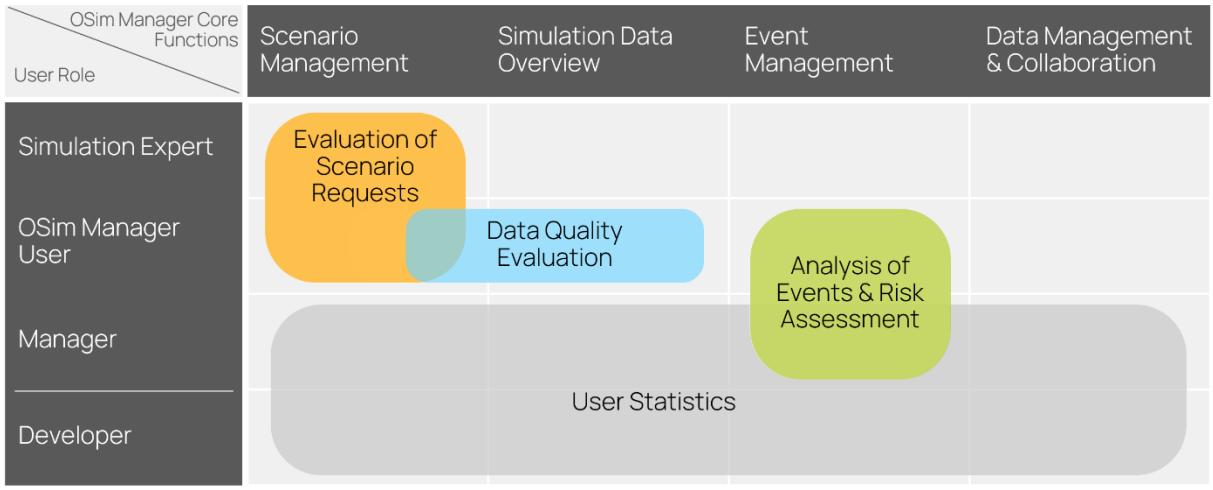


Fig: Options for additional data-based functions

Possible functions and requirements

The timely sharing of simulation/planning results is a prerequisite for the successful collaborative use of OSim Manager. However, new planning or rescheduling involves time and effort. Particularly in scenario management, every request means additional work without any direct benefit for the user. Data-based analysis functions can help to reduce the simulation effort and response time for scenario requests by assessing the feasibility of requirements and pointing out possible difficulties.

Not only the timeliness of the exchanged data, but also an overall sufficient data quality is an essential basis for the use of the OSim Manager. A continuous evaluation of the quality of the data received from supply chain partners, primarily the simulation data, enables the user to assess its reliability and initiate short and medium-term measures to improve data quality.

Both functions require simulation and scenario data to be stored and accessible via the OSim Manager. Additional data, such as stock levels and resource availability in the company's own operations or actual data related to planning data of supply chain partners, are not absolutely necessary, but can improve the assessment of the feasibility of scenario requests and the evaluation of data quality. However, the OSim Manager explicitly does not provide any interfaces to other internal systems (ERP system or similar) in addition to the simulation

interface (see chapter Simulation Interface). The following detailing of the functions mentioned is therefore based on the exclusive meeting of the minimum requirements.

In event management , the occurrence of past disruptive events can be described using descriptive and statistical methods. The effects of disruptive events can be analyzed by linking them with simulation results. This information also supports a user-specific risk assessment of current disruptive events. Methods from the field of text mining or machine learning, for example, are suitable for the (partially) automated interpretation of possibly unstructured data from external sources.

Scenario request assessment

Purpose/Objective: The feasibility of requested scenarios is checked automatically. If a scenario request cannot be met, it is not necessary to run a simulation. This reduces the simulation effort. In addition, the user is supported by receiving information on unusual features and possible problems with the request.

Input variables: The subject of the evaluation is a scenario request. This often consists of scenario-specific data objects ("scenarioHeaders", "scenarioParameters" etc.) and two simulation results (see data flows and simulations in scenario management context) - whenever it is a simulation result-based request that is forwarded to the downstream companies. Depending on the user role, different information is relevant. Logisticians require data on

- Delivery location and time, destination and delivery date,
- Handling units (type, number, dimensions, weight),
- hazardous goods.

Manufacturers need to know

- the current required quantity per item and the expected delivery date and
- if applicable, the delivery quantity and time by suppliers for purchased parts and raw materials.

When assessing the feasibility of a scenario, in addition to the current request, the change compared to the initial request and the total requirement can also be taken into account. The latter does not result solely from the scenario request, but must be derived from the previous simulation results.

The feasibility assessment is based on historical data. In addition to the data objects of each request, the respective assessment (willingness to implement or reject) by the user must also be available.

Output variables: The user receives a recommendation on how to deal with the request, e.g. "Request can be fulfilled", "Request must be checked", "Request cannot be fulfilled". In addition to the assessment, the user should also be shown reasons for the assessment or possible causes of

a rejection. This helps the user to identify the critical aspects of a request. This is particularly important if requests consist of scenario bulks and simulation results also contain deliveries that are not directly related to the request.

Notes on implementation: Possible approaches for assessing the feasibility are

1. Limit values or ranges using simple statistical methods from historical data and checking current queries against these thresholds
2. Prediction of feasibility through classification methods, e.g. use of neural networks
3. Evaluation of the similarity of queries/change in queries, e.g. through cluster analysis

Re (1): As described above, it is advisable to set different priorities depending on the type of user company (logistician or producer). Possible tests are, for example

- Logistician: Can a route be completed in a given time? Can load carrier dimensions be handled?
- Manufacturer: Are minimum order quantities adhered to for all items? Can the requested items be provided on the expected delivery date?

With options (2) and (3), the definition and weighting of the tests may not be necessary (depending on the selected method). On the other hand, it becomes more difficult to explain the results.

Data quality evaluation

Purpose/Objective: In addition to the simulation results of the supply chain partners, the OSim Manager user receives information on the expected quality of the data. This allows them to take action if necessary, e.g. to plan buffers in their own production planning or when making inquiries, or to coordinate approaches for improving data quality together with the respective partner.

Input variables: The simulation data, i.e. data from the "simulationRuns" entity and associated entities ("shipments", "handlingUnits" and "materialBatches"), are primarily suitable for the evaluation. Specifically, this involves data on deliveries, including

- Metadata: Time of the simulation, assessment of the credibility of the simulation results by the sender
- Delivery location and logisticians involved in the delivery
- Type, number and weight of loading units
- Article number, name and quantity, order number

In addition, data from the scenario management context can be included in the evaluation, e.g. the time of an inquiry in relation to the expected delivery date. Trends can be determined by analyzing historical data.

Output variables: The result of the evaluation is an indication of deficits and potential for improvement in the supply chain partner data. A multi-level presentation of the results is useful in order to give the user a quick overview of the data quality on the one hand and to enable a detailed analysis of the deficits on the other. The illustration uses three levels as an example:

- The first level is integrated into the visualization of the supplier-customer network and aggregates the result in an arrow symbol that describes an overall assessment of the data quality (good/sufficient/poor; shown here via the color) and a summarizing trend (improving/constant/decreasing; shown here via the direction of the arrow).
- The second level breaks down the overall result into key figures that represent various aspects of the data quality assessment.
- The third level (not detailed here) can be used to show the progression of values over time and to highlight specific deficits.

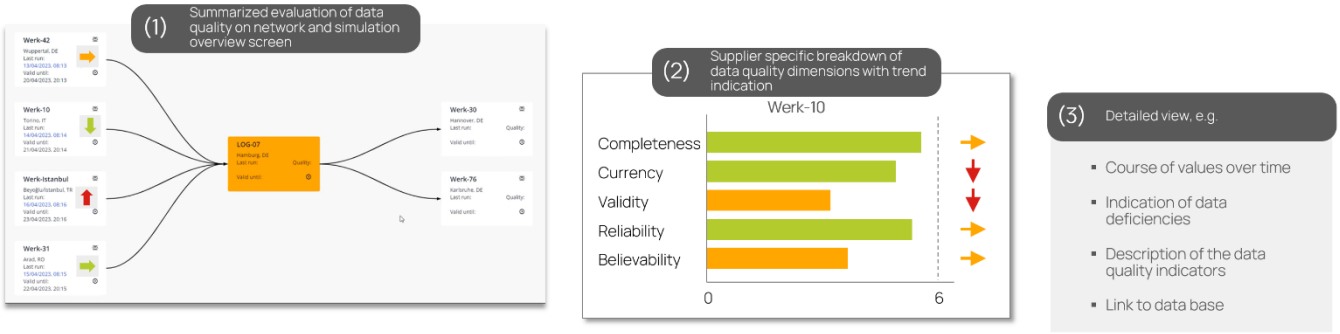


Figure: Exemplary three-stage representation of data quality

Notes on implementation: The exemplary illustration uses criteria and approaches known from the field of data quality assessment to describe data quality (figure, level 2). Conventional data analysis methods can be used to determine trends, such as the slope direction of a regression line or the trend component from a time series model. Regardless of the chosen actual implementation of an add-on for data quality assessment, the following overall conditions must be taken into account:

- The exchanged data corresponds to the standardized OSim data model. This means, for example, that completeness should only be assessed for optional values. The evaluation method must be able to handle nested data structures.
- The evaluation must be able to be fully automated.
- The result of the evaluation should be understandable for the data consumer or the main user of the OSim Manager.

Test data

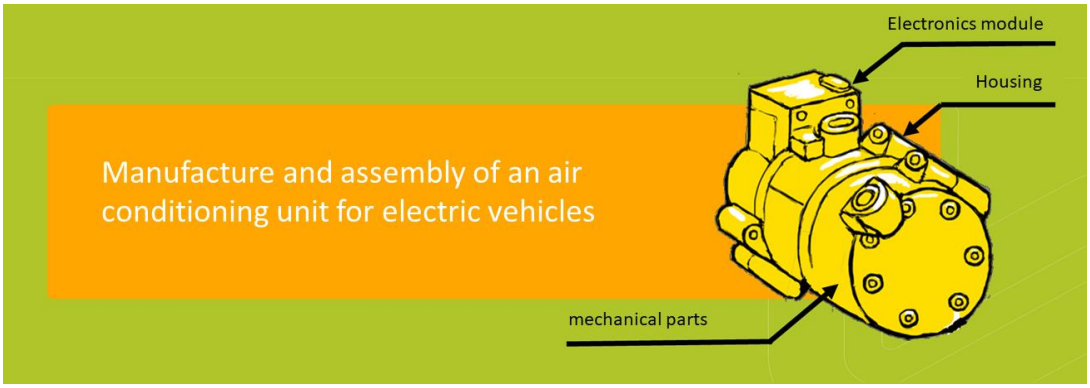
General

This chapter describes a fictitious use case and a test environment that can be used when implementing the OSim Manager. A distinction is made between a basic flow and scenario flow-based structure, the network sections are defined and the data packets for logisticians and producers are provided in each case.

This allows the functionality of the OSim modules and interfaces to be tested without a connection to real systems.

Use Case

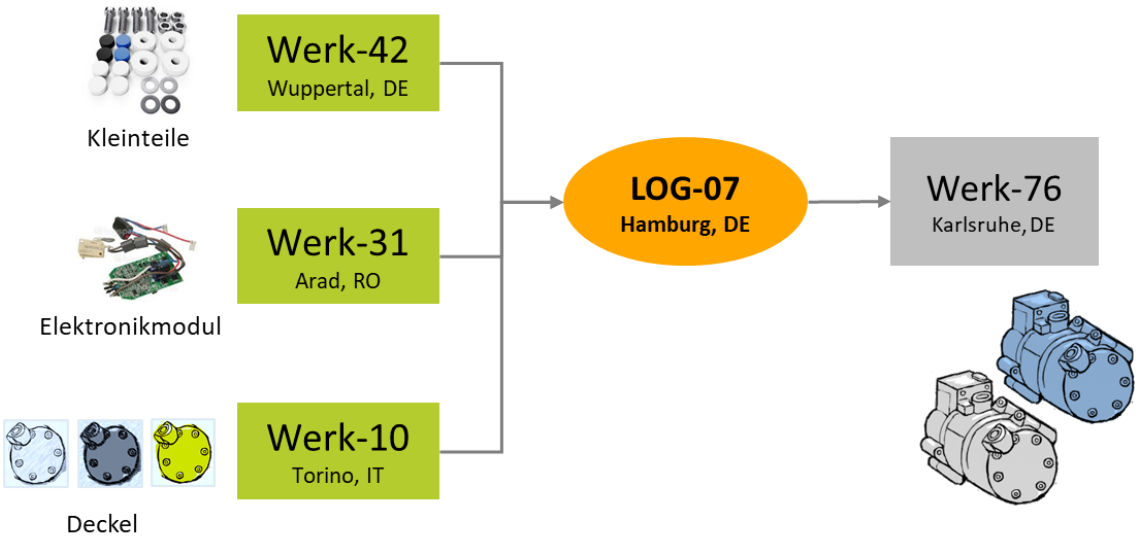
The use case is about the final assembly of an air conditioning unit that consists of several components from different manufacturers. These include the housing, cover, electronics module and small parts.



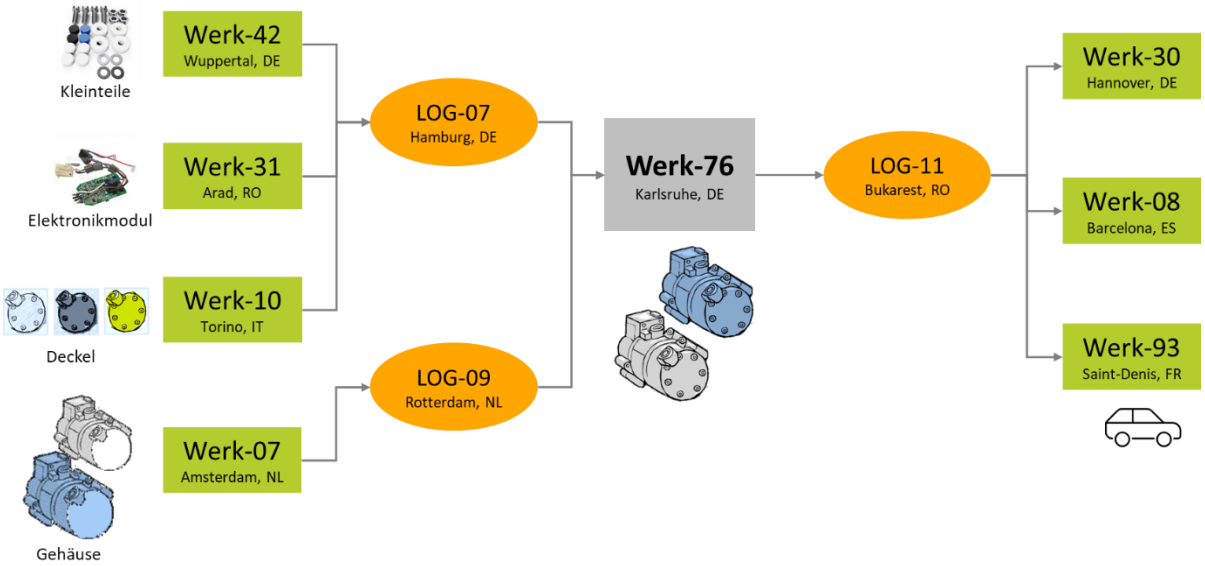
Basic flow

At least two OSim participants in the two roles of logistician and producer are required to map the basic flow.

The following sketch shows the network section from the **perspective of the logistics** provider "LOG-07", which transports the small parts from the supplier "Werk-42", electronic modules from the supplier "Werk-31" and the lids from the supplier "Werk-10" to the final assembly plant "Werk-76".



The following sketch shows the network section from the **perspective of the final assembly plant** "Werk-76". The two logisticians "LOG-07" and "LOG-09" are responsible for delivering the parts. Logistician "LOG-11" is responsible for the onward transport of the air conditioning units produced. The suppliers and customers of the final assembly plant "Werk-76" are purely for information purposes, as the data flows are handled by the logisticians.



Scenario flow

To map the scenario flow, at least two OSim participants are also required in the two roles of logistician and producer.

In contrast to the basic flow, however, communication does not only take place in the direction of the higher tier, but can take place in both directions depending on the scenario, as well as some participants making multiple requests. The following two diagrams illustrate the basic possibilities of data exchange.

Scenario "Changed delivery times"

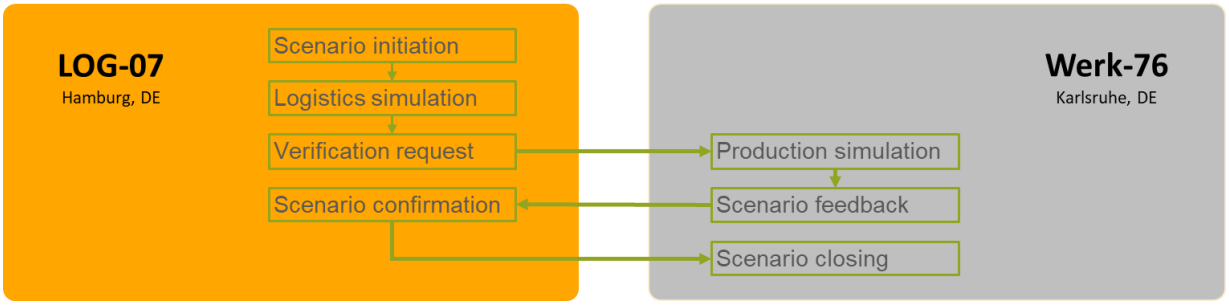
This scenario is initiated by the logistician "LOG-07" and concerns the final assembly plant "Werk-76", where the delivery arrives.

The logistics provider carries out a simulation of its own operations in order to analyse the exact impact on the surrounding supply chain. In this case, the simulation result is transferred to the final assembly plant concerned.

The final assembly plant in turn carries out a simulation of its own operation, taking into account the scenario-related results of the logistics provider, and analyses this.

Depending on the result of the analysis, the final assembly plant sends positive or negative feedback back to the logistics provider.

The logistician, as the initiator of the scenario, checks the feedback, decides on the final implementation of the scenario and informs the final assembly plant accordingly.



Scenario "Changed delivery time window"

This scenario is initiated by the final assembly plant "Werk-76" and concerns the logistics provider "LOG-07", which carries out the delivery.

As the scenario is directed to a subordinate network partner, the initiation in the final assembly plant is followed directly by a request for feedback from the logistician and no simulation in the final assembly plant. The change is described in text form or defined in the form of parameter sets.

The logistics provider then carries out a simulation of their own operation in order to analyse the exact impact. This results in changed delivery times for the logistics provider. The affected partners are asked for confirmation.

In this case, the logistics provider sends a feedback request to the final assembly plant, which includes the simulation results.

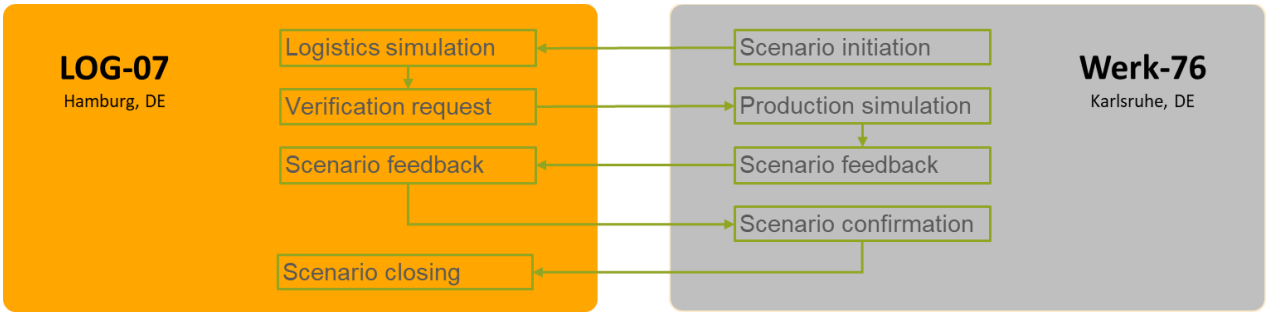
For its part, the final assembly plant carries out a simulation of its own operation, taking into account the scenario-related results of the logistics provider, and analyses this.

Depending on the result of the analysis, the final assembly plant sends positive or negative feedback back to the logistics provider.

The logistics provider can now pass on this decision and in this case sends its feedback to the final assembly plant.

The final assembly plant, as the initiator of the scenario, checks the feedback, decides on the final implementation of the scenario and informs the logistics provider.

Dieses Szenario wird durch das Endmontagewerk "Werk-76" initiiert und betrifft den Logistiker "LOG-07", der die Lieferung durchführt.



Dataset for network configuration

With reference to the binding data sovereignty restriction to one-up-one-down, only the direct suppliers, customers and the logistics providers involved are configured as partners.

Bezugnehmend auf die verbindliche Datensouveränitäts-Beschränkung auf One-Up-One-Down werden jeweils nur die direkten Lieferanten, Kunden sowie die eingebundenen Logistiker als Partner konfiguriert.

The following dataset contains information on the company profiles and their locations that were used in the use case.

These are

- the companies (legal entities),
- the assigned locations (Sites)
- and finally the addresses (Addresses)

To refer from a legal entity to an address of the head office, this link is specified separately.

As the OSim instances are operated at the operating level, the locations are decisive for data exchange.

Note-1: The external IDs in the dataset correspond to the globally unique Business Partner Number (BPN) assigned in Catena-X Business Partner Data Management.

Note-2: The assignment of the partners in the network (predecessor/successor) must be carried out in the OSim Manager.

Note-3: The details of your own instance must also be included in this dataset. A location is marked as a separate instance in the OSim Manager.

Dataset for the logistics node "LOG-07"

Legal Entities

bpnl_external_id	bpnl_cx_managed	bpnl_company_name	bpnl_contact_name	bpnl_contact_email	bpnl_contact_phone
TIER-2_RO	0	TIER-2_RO	Mensch-1	Mensch-1@gmail.com	+49 171 453737456
TIER-2_IT	0	TIER-2_IT	Mensch-2	Mensch-2@gmail.com	+49 171 453737457
TIER-2_ DE	0	TIER-2_ DE	Mensch-3	Mensch-3@gmail.com	+49 171 453737458
TIER-1_DE	1	TIER-1_DE	Mensch-5	Mensch-5@gmail.com	+49 171 453737460
LOG_DE	1	LOG_HAM	Mensch-9	Mensch-9@gmail.com	+49 171 453737464

Sites

bpnl_external_id	bpns_external_id	bpns_name	bpns_cx_managed

TIER-2_RO	TIER-2_RO_ARA	Arad	0
TIER-2_IT	TIER-2_IT_TOR	Torino	0
TIER-2_ DE	TIER-2_ DE_WUP	Wuppertal	0
TIER-1_DE	TIER-1_DE_KHE	Karlsruhe	1
LOG_DE	LOG_DE_HAM	Hamburg	1

Addresses

bpns_external_id	bpna_external_id	bpna_internal_id	bpna_name	bpna_country	bpna_postcode	bpna_city	bpna_street	bpna_building	bpna_cx_managed	bpna_contact_name	bpna_contact_email	bpna_contact_phone
TIER-2_RO_ARA	TIER-2_RO_31	RO-Werk-31	Werk-31	Romania	310349	Arad	Strada izvor	5	0	Mensch-1	Mensch-1@gmail.com	+49 171 453737456
TIER-2_IT_TOR	TIER-2_IT_10	IT-Werk-10	Werk-10	Italy	10139	Torino	Via barge	4	0	Mensch-2	Mensch-2@gmail.com	+49 171 453737457
TIER-2_DE_WUP	TIER-2_DE_42	DE-Werk-42	Werk-42	Germany	42105	Wuppertal	Markomannenstraße	41	0	Mensch-3	Mensch-3@gmail.com	+49 171 453737458
TIER-1_DE_KHE	TIER-1_DE_76	DE-Werk-76	Werk-76	Germany	76149	Karlsruhe	Neureuter Hauptstraße	2	1	Mensch-5	Mensch-5@gmail.com	+49 171 453737460
LOG_DE_HAM	LOG_DE_07	DE-Log-07	LOG-07	Germany	22081	Hamburg	Uferstraße	14	1	Mensch-9	Mensch-9@gmail.com	+49 171 453737464

Legal Entity Addresses

bpnl_external_id	bpna_external_id
TIER-2_RO	TIER-2_RO_31
TIER-2_IT	TIER-2_IT_10
TIER-2_ DE	TIER-2_ DE_42
TIER-1_DE	TIER-1_DE_76
LOG_DE	LOG_DE_07

Dataset for the production node "Werk-76"

Legal Entities

bpnl_external_id	bpnl_cx_managed	bpnl_company_name	bpnl_contact_name	bpnl_contact_email	bpnl_contact_phone
TIER-2_RO	0	TIER-2_RO	Mensch-1	Mensch-1@gmail.com	+49 171 453737456
TIER-2_IT	0	TIER-2_IT	Mensch-2	Mensch-2@gmail.com	+49 171 453737457
TIER-2_ DE	0	TIER-2_ DE	Mensch-3	Mensch-3@gmail.com	+49 171 453737458
TIER-2_ NL	0	TIER-2_ NL	Mensch-4	Mensch-4@gmail.com	+49 171 453737459
TIER-1_DE	1	TIER-1_DE	Mensch-5	Mensch-5@gmail.com	+49 171 453737460
OEM_FR	0	TIER_FR	Mensch-6	Mensch-6@gmail.com	+49 171 453737461
OEM_ES	0	TIER_ES	Mensch-7	Mensch-7@gmail.com	+49 171 453737462
OEM_DE	0	TIER_DE	Mensch-8	Mensch-8@gmail.com	+49 171 453737463
LOG_DE	1	LOG_HAM	Mensch-9	Mensch-9@gmail.com	+49 171 453737464
LOG_NL	0	LOG_ROT	Mensch-10	Mensch-10@gmail.com	+49 171 453737465
LOG_RO	0	LOG_BUK	Mensch-11	Mensch-11@gmail.com	+49 171 453737466

Sites

bpnl_external_id	bpns_external_id	bpns_name	bpns_cx_managed
TIER-2_RO	TIER-2_RO_ARA	Arad	0
TIER-2_IT	TIER-2_IT_TOR	Torino	0
TIER-2_ DE	TIER-2_ DE_WUP	Wuppertal	0
TIER-2_ NL	TIER-2_ NL_AMS	Amsterdam	0
TIER-1_DE	TIER-1_DE_KHE	Karlsruhe	1
OEM_FR	OEM_FR_SD	Saint-Denis	0
OEM_ES	OEM_ES_BAR	Barcelona	0
OEM_DE	OEM_DE_HAN	Hannover	0
LOG_DE	LOG_DE_HAM	Hamburg	1
LOG_NL	LOG_NL_ROT	Rotterdam	0
LOG_RO	LOG_RO_BUK	Búkarest	0

Addresses

bpns_external_id	bpna_external_id	bpna_internal_id	bpna_name	bpna_country	bpna_postcode	bpna_city	bpna_street	bpna_building	bpna_cx_managed	bpna_contact_name	bpna_contact_email	bpna_contact_phone

TIER-2_RO_ARA	TIER-2_RO_31	RO-Werk-31	Werk-31	Romania	310349	Arad	Strada izvor	5	0	Mensch-1	Mensch-1@gmail.com	+49 171 453737456
TIER-2_IT_TOR	TIER-2_IT_10	IT-Werk-10	Werk-10	Italy	10139	Torino	Via barge	4	0	Mensch-2	Mensch-2@gmail.com	+49 171 453737457
TIER-2_DE_WUP	TIER-2_DE_42	DE-Werk-42	Werk-42	Germany	42105	Wuppertal	Markomannenstraße	41	0	Mensch-3	Mensch-3@gmail.com	+49 171 453737458
TIER-2_NL_AMS	TIER-2_NL_07	NL-Werk-07	Werk-07	Netherlands	1014	Amsterdam	De Heusweg	105	0	Mensch-4	Mensch-4@gmail.com	+49 171 453737459
TIER-1_DE_KHE	TIER-1_DE_76	DE-Werk-76	Werk-76	Germany	76149	Karlsruhe	Neureuter Hauptstraße	2	1	Mensch-5	Mensch-5@gmail.com	+49 171 453737460
OEM_FR_SD	OEM_FR_93	FR-Werk-93	Werk-93	France	93200	Saint-Denis	Bd Marcel Sembat	19	0	Mensch-6	Mensch-6@gmail.com	+49 171 453737461
OEM_ES_BAR	OEM_ES_08	ES-Werk-08	Werk-08	Spain	08002	Barcelona	Carrer de Segovia	56	0	Mensch-7	Mensch-7@gmail.com	+49 171 453737462
OEM_DE_HAN	OEM_DE_30	DE-Werk-30	Werk-30	Germany	30457	Hannover	Beckstrasse	14	0	Mensch-8	Mensch-8@gmail.com	+49 171 453737463
LOG_DE_HAM	LOG_DE_07	DE-Log-07	LOG-07	Germany	22081	Hamburg	Uferstraße	14	1	Mensch-9	Mensch-9@gmail.com	+49 171 453737464
LOG_NL_ROT	LOG_NL_09	NL-Log-09	LOG-09	Netherlands	3011	Rotterdam	Overblaak	99	0	Mensch-10	Mensch-10@gmail.com	+49 171 453737465
LOG_RO_BUK	LOG_RO_11	RO-Log-11	LOG-11	Romania	110018	Pitești	Bulevardul Republicii	45	0	Mensch-11	Mensch-11@gmail.com	+49 171 453737466

Legal Entity Addresses

bpnl_external_id	bpna_external_id
TIER-2_RO	TIER-2_RO_31
TIER-2_IT	TIER-2_IT_10
TIER-2_ DE	TIER-2_ DE_42
TIER-2_ NL	TIER-2_ NL_07
TIER-1_DE	TIER-1_DE_76
OEM_FR	OEM_FR_93
OEM_ES	OEM_ES_08

OEM_DE	OEM_DE_30
LOG_DE	LOG_DE_07
LOG_NL	LOG_NL_09
LOG_RO	LOG_RO_11

Dataset for basic flow

The following datasets contain information on the simulation results that are exchanged between the network partners.

These are

- the simulation run description (SimulationRun),
- the assigned deliveries (Shipment),
- the delivery objects (HandlingUnit)
- and the materials (MaterialBatch).

Datasets für die Logistik-Instanz "LOG-07"

In relation to the use case, the logistics provider receives 3 data records from the upstream suppliers: "Werk-42", "Werk-31" and "Werk-10". These data records can be imported by the logistics provider using Excel (see Importing the sim results from Excel).

Simulation result from "Werk-42"

SimulationRun

simulation_owner	simulation_description	simulation_timestamp	simulation_data_quality	simulation run id	simulation_comment	simulation_expiration_timestamp
TIER-2_DE_42	Standardsimulation	05.11.2023 08:13	High	S3	good run!	12.11.2023 20:13

Shipment

shipment_number	shipment_simulation_run	shipment_destination	shipment_destination_timestamp	shipment_recipient	shipment_recipient_timestamp_planned	shipment_splitting_allowed	shipment_logistics	shipment_preceding
DE515151	S3	TIER-2_DE_42	06.11.2023 18:14	TIER-1_DE_76	07.11.2023 17:00	1	LOG_DE_07	

DE515152	S3	TIER-2_DE_42	07.11.2023 10:47	TIER-1_DE_76	08.11.2023 17:00	1	LOG_DE_07	
DE515153	S3	TIER-2_DE_42	08.11.2023 14:25	TIER-1_DE_76	09.11.2023 17:00	1	LOG_DE_07	
DE515154	S3	TIER-2_DE_42	09.11.2023 20:17	TIER-1_DE_76	10.11.2023 17:00	1	LOG_DE_07	
DE515155	S3	TIER-2_DE_42	10.11.2023 09:35	TIER-1_DE_76	13.11.2023 17:00	1	LOG_DE_07	

HandlingUnit

handling_unit_number	handling_unit_shipment	hut_name	handling_unit_volume	handling_unit_weight	handling_unit_amount
HUT_1	DE515151	Pallette	1	189	1
HUT_2	DE515152	Pallette	1	189	1
HUT_3	DE515153	Pallette	1	189	1
HUT_4	DE515154	Pallette	1	189	1
HUT_5	DE515155	Pallette	1	189	1
HUT_6	DE515155	Pallette	1	189	1

MaterialBatch

batch_number	batch_handling_unit	material_number	material_name	material_hazardous_goods	batch_expiration_timestamp	batch_quantity	uom_name	batch_serial_number	batch_order_id
Batch_1	HUT_1	KK1000GR	KK1000GR-Gehäuse-Rot	0	22.08.2024 16:00	50	Stk	45	Order-DE_0001
Batch_2	HUT_1	KK1000GG	KK1000GG-Gehäuse-Grün	0	23.08.2024 16:00	25	Stk	46	Order-DE_0001
Batch_3	HUT_1	KK1000GB	KK1000GB-Gehäuse-Blau	0	24.08.2024 16:00	25	Stk	47	Order-DE_0001
Batch_4	HUT_2	KK1000GR	KK1000GR-Gehäuse-Rot	0	28.08.2024 16:00	50	Stk	51	Order-DE_0002

Batch_5	HUT_2	KK1000GG	KK1000 GG-Gehäuse-Grün	0	29.08.2024 16:00	25	Stk	52	Order-DE_0002
Batch_6	HUT_2	KK1000GB	KK1000 GB-Gehäuse-Blau	0	30.08.2024 16:00	25	Stk	53	Order-DE_0002
Batch_7	HUT_3	KK1000GR	KK1000 GR-Gehäuse-Rot	0	03.09.2024 16:00	50	Stk	57	Order-DE_0003
Batch_8	HUT_3	KK1000GG	KK1000 GG-Gehäuse-Grün	0	04.09.2024 16:00	25	Stk	58	Order-DE_0003
Batch_9	HUT_3	KK1000GB	KK1000 GB-Gehäuse-Blau	0	05.09.2024 16:00	25	Stk	59	Order-DE_0003
Batch_10	HUT_4	KK1000GR	KK1000 GR-Gehäuse-Rot	0	09.09.2024 16:00	50	Stk	63	Order-DE_0004
Batch_11	HUT_4	KK1000GG	KK1000 GG-Gehäuse-Grün	0	10.09.2024 16:00	25	Stk	64	Order-DE_0004
Batch_12	HUT_4	KK1000GB	KK1000 GB-Gehäuse-Blau	0	11.09.2024 16:00	25	Stk	65	Order-DE_0004
Batch_13	HUT_5	KK1000GR	KK1000 GR-Gehäuse-Rot	0	15.09.2024 16:00	50	Stk	69	Order-DE_0005
Batch_14	HUT_5	KK1000GG	KK1000 GG-Gehäuse-Grün	0	16.09.2024 16:00	25	Stk	70	Order-DE_0005
Batch_15	HUT_5	KK1000GB	KK1000 GB-Gehäuse-Blau	0	17.09.2024 16:00	25	Stk	71	Order-DE_0005
Batch_14_2	HUT_6	KK1000GG	KK1000 GG-Gehäuse-Grün	0	16.09.2024 16:00	25	Stk	70	Order-DE_0005
Batch_15_2	HUT_6	KK1000GB	KK1000 GB-Gehäuse-Blau	0	17.09.2024 16:00	25	Stk	71	Order-DE_0005

Simulation result from "Werk-31"

SimulationRun

simulation_owner	simulation_description	simulation_timestamp	simulation_data_quality	simulation_run_id	simulation_comment	simulation_expiration_timestamp
TIER-2_RO_31	Standardsimulation	04.11.2023 08:15	High	S1	good run!	11.11.2023 20:15

Shipment

shipment_number	shipment_simulation_run	shipment_destination	shipment_destination_timestamp	shipment_recipient	shipment_recipient_timestamp_planned	shipment_splitting_allowed	shipment_logistics	shipment_preceding
RO456489415	S1	TIER-2_RO_31	06.11.2023 15:02	TIER-1_DE_76	13.04.2023 16:00	1	LOG_DE_07	
RO456489416	S1	TIER-2_RO_31	07.11.2023 14:38	TIER-1_DE_76	14.04.2023 16:00	1	LOG_DE_07	
RO456489417	S1	TIER-2_RO_31	08.11.2023 15:22	TIER-1_DE_76	15.04.2023 16:00	1	LOG_DE_07	
RO456489418	S1	TIER-2_RO_31	09.11.2023 15:33	TIER-1_DE_76	16.04.2023 16:00	1	LOG_DE_07	
RO456489419	S1	TIER-2_RO_31	10.11.2023 14:08	TIER-1_DE_76	17.04.2023 16:00	1	LOG_DE_07	

HandlingUnit

handling_unit_number	handling_unit_shipment	hut_name	handling_unit_volume	handling_unit_weight	handling_unit_amount
HUT_1	RO456489415	Pallette	1	189	1
HUT_2	RO456489416	Pallette	1	189	1
HUT_3	RO456489417	Pallette	1	189	1
HUT_4	RO456489418	Pallette	1	189	1
HUT_5	RO456489419	Pallette	1	189	1

MaterialBatch

batch_number	batch_handling_unit	material_number	material_name	material_hazardous_goods	batch_expiration_timestamp	batch_quantity	uom_name	batch_serial_number	batch_order_id
Batch_1	HUT_1	KK1000KTA	KK1000 KTA-Kleinteile-A	0	18.07.2025 08:10	100	Stk	143	Order-RO_0001
Batch_2	HUT_1	KK1000KTB	KK1000 KTB-Kleinteile-B	0	19.07.2025 08:10	50	Stk	145	Order-RO_0001
Batch_3	HUT_2	KK1000KTA	KK1000 KTA-Kleinteile-A	0	20.07.2025 08:10	100	Stk	147	Order-RO_0002
Batch_4	HUT_2	KK1000KTB	KK1000 KTB-Kleinteile-B	0	21.07.2025 08:10	50	Stk	149	Order-RO_0002
Batch_5	HUT_3	KK1000KTA	KK1000 KTA-Kleinteile-A	0	22.07.2025 08:10	100	Stk	151	Order-RO_0003
Batch_6	HUT_3	KK1000KTB	KK1000 KTB-Kleinteile-B	0	23.07.2025 08:10	50	Stk	153	Order-RO_0003
Batch_7	HUT_4	KK1000KTA	KK1000 KTA-Kleinteile-A	0	24.07.2025 08:10	100	Stk	155	Order-RO_0004
Batch_8	HUT_4	KK1000KTB	KK1000 KTB-Kleinteile-B	0	25.07.2025 08:10	50	Stk	157	Order-RO_0004
Batch_9	HUT_5	KK1000KTA	KK1000 KTA-Kleinteile-A	0	26.07.2025 08:10	100	Stk	159	Order-RO_0005
Batch_10	HUT_5	KK1000KTB	KK1000 KTB-Kleinteile-B	0	27.07.2025 08:10	50	Stk	161	Order-RO_0005

Simulation result from "Werk-10"

SimulationRun

simulation_owner	simulation_description	simulation_timestamp	simulation_data_quality	simulation run id	simulation_comment	simulation_expiration_timestamp

TIER-2_IT_10	Standardsimulation	05.11.2023 08:14	High	S3	test run	12.11.2023 20:14

Shipment

shipment_number	shipment_simulation_run	shipment_destination	shipment_destination_timestamp	shipment_recipient	shipment_recipient_timestamp_planned	shipment_splitting_allowed	shipment_logistics	shipment_preceding
IT4646511	S3	TIER-2_IT_10	06.11.2023 12:06	TIER-1_DE_76	09.11.2023 09:12	1	LOG_DE_07	
IT4646512	S3	TIER-2_IT_10	07.11.2023 12:28	TIER-1_DE_76	10.11.2023 09:12	1	LOG_DE_07	
IT4646513	S3	TIER-2_IT_10	08.11.2023 13:46	TIER-1_DE_76	13.11.2023 09:12	1	LOG_DE_07	
IT4646514	S3	TIER-2_IT_10	09.11.2023 11:39	TIER-1_DE_76	14.11.2023 09:12	1	LOG_DE_07	
IT4646515	S3	TIER-2_IT_10	10.11.2023 13:14	TIER-1_DE_76	15.11.2023 09:12	1	LOG_DE_07	

HandlingUnit

handling_unit_number	handling_unit_shipment	hut_name	handling_unit_volume	handling_unit_weight	handling_unit_amount
HUT_1	IT4646511	Pallette	1	102	1
HUT_2	IT4646512	Pallette	1	102	1
HUT_3	IT4646513	Pallette	1	102	1
HUT_4	IT4646514	Pallette	1	102	1
HUT_5	IT4646515	Pallette	1	102	1
HUT__2	IT4646515	Pallette	1	102	1

MaterialBatch

batch_number	batch_handling_unit	material_number	material_name	material_hazardous_goods	batch_expiration_timestamp	batch_quantity	uom_name	batch_serial_number	batch_order_id
Batch_1	HUT_1	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	18.07.2024 08:11	100	Stk	77	Order-IT_1001

Batch_2	HUT_1	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	19.07.2024 08:11	50	Stk	79	Order-IT_1001
Batch_3	HUT_2	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	20.07.2024 08:11	100	Stk	81	Order-IT_1002
Batch_4	HUT_2	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	21.07.2024 08:11	50	Stk	83	Order-IT_1002
Batch_5	HUT_3	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	22.07.2024 08:11	100	Stk	85	Order-IT_1003
Batch_6	HUT_3	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	23.07.2024 08:11	50	Stk	87	Order-IT_1003
Batch_7	HUT_4	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	24.07.2024 08:11	100	Stk	89	Order-IT_1004
Batch_8	HUT_4	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	25.07.2024 08:11	50	Stk	91	Order-IT_1004
Batch_9	HUT_5	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	26.07.2024 08:11	100	Stk	93	Order-IT_1005
Batch_10	HUT_5	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	27.07.2024 08:11	50	Stk	95	Order-IT_1005
Batch_9_2	HUT_5_2	KK1000KTA	KK1000EMA-Elektronikmodul-A	0	26.07.2024 08:11	100	Stk	93	Order-IT_1005
Batch_10_2	HUT_5_2	KK1000KTB	KK1000EMA-Elektronikmodul-B	0	27.07.2024 08:11	50	Stk	95	Order-IT_1005

Datasets für die Produktion-Instanz "Werk-76"

In relation to the use case, the final assembly plant receives 2 data records from the upstream logistics providers: "LOG-07" and "LOG-09". These data records can be imported into the OSim Manager using Excel (see Importing the sim results from Excel).

Alternatively, the simulation results of the connected logistician "LOG-07" can be imported automatically via the EDC interface.

Simulation result from "LOG-07"

SimulationRun

simulation_owner	simulation_description	simulation_timestamp	simulation_data_quality	simulation_run_id	simulation_comment	simulation_expiration_timestamp
LOG_DE_07	Standardsimulation	28.02.2023 09:20	High	S5	test run	01.03.2023 09:20

Shipment

shipment_number	shipment_simulation_run	shipment_destination	shipment_destination_timestamp	shipment_recipient	shipment_recipient_timestamp_planned	shipment_splitting_allowed	shipment_logistics	shipment_preceding
DE56416516	S5	TIER-1_DE_76	24.01.2023 20:00	TIER-1_DE_76	25.01.2023 09:00	1	LOG_DE_07	S3-1
DE56416517	S5	TIER-1_DE_76	25.01.2023 20:00	TIER-1_DE_76	26.01.2023 09:00	1	LOG_DE_07	S3-2
DE56416518	S5	TIER-1_DE_76	26.01.2023 20:00	TIER-1_DE_76	27.01.2023 09:00	1	LOG_DE_07	S3-3
DE56416519	S5	TIER-1_DE_76	27.01.2023 20:00	TIER-1_DE_76	28.01.2023 09:00	1	LOG_DE_07	S3-4
DE56416520	S5	TIER-1_DE_76	28.01.2023 20:00	TIER-1_DE_76	29.01.2023 09:00	1	LOG_DE_07	S3-5
DE56416521	S5	TIER-1_DE_76	24.01.2023 20:00	TIER-1_DE_76	25.01.2023 09:00	1	LOG_DE_07	S2-1
DE56416522	S5	TIER-1_DE_76	25.01.2023 20:00	TIER-1_DE_76	26.01.2023 09:00	1	LOG_DE_07	S2-2
DE56416523	S5	TIER-1_DE_76	26.01.2023 20:00	TIER-1_DE_76	27.01.2023 09:00	1	LOG_DE_07	S2-3
DE56416524	S5	TIER-1_DE_76	27.01.2023 20:00	TIER-1_DE_76	28.01.2023 09:00	1	LOG_DE_07	S2-4
DE56416525	S5	TIER-1_DE_76	28.01.2023 20:00	TIER-1_DE_76	29.01.2023 09:00	1	LOG_DE_07	S2-5
DE56416526	S5	TIER-1_DE_76	24.01.2023 20:00	TIER-1_DE_76	25.01.2023 09:00	1	LOG_DE_07	S1-1
DE56416527	S5	TIER-1_DE_76	25.01.2023 20:00	TIER-1_DE_76	26.01.2023 09:00	1	LOG_DE_07	S1-2
DE56416528	S5	TIER-1_DE_76	26.01.2023 20:00	TIER-1_DE_76	27.01.2023 09:00	1	LOG_DE_07	S1-3

DE56416529	S5	TIER-1_DE_76	27.01.2023 20:00	TIER-1_DE_76	28.01.2023 09:00	1	LOG_DE_07	S1-4
DE56416530	S5	TIER-1_DE_76	28.01.2023 20:00	TIER-1_DE_76	29.01.2023 09:00	1	LOG_DE_07	S1-5

HandlingUnit

handling_unit_number	handling_unit_shipment	hut_name	handling_unit_volume	handling_unit_weight	handling_unit_amount
HUT_1	DE56416516	Pallette	1	189	1
HUT_2	DE56416517	Pallette	1	189	1
HUT_3	DE56416518	Pallette	1	189	1
HUT_4	DE56416519	Pallette	1	189	1
HUT_5	DE56416520	Pallette	1	189	1
HUT_6	DE56416521	Pallette	1	102	1
HUT_7	DE56416522	Pallette	1	102	1
HUT_8	DE56416523	Pallette	1	102	1
HUT_9	DE56416524	Pallette	1	102	1
HUT_10	DE56416525	Pallette	1	102	1
HUT_11	DE56416526	Pallette	1	189	1
HUT_12	DE56416527	Pallette	1	189	1
HUT_13	DE56416528	Pallette	1	189	1
HUT_14	DE56416529	Pallette	1	189	1
HUT_15	DE56416530	Pallette	1	189	1

MaterialBatch

batch_number	batch_handling_unit	material_number	material_name	material_hazardous_goods	batch_expiration_timestamp	batch_quantity	uom_name	batch_serial_number	batch_order_id
DE184151	HUT_1	KK1000GR	KK1000GR-Gehäuse-Rot	0	22.08.2024 16:00	10	Stk	45	Order-1001
DE184152	HUT_1	KK1000GG	KK1000GG-Gehäuse-Grün	0	23.08.2024 16:00	11	Stk	46	Order-1001

DE184153	HUT_1	KK1000GB	KK1000GB-Gehäuse-Blau	0	24.08.2024 16:00	12	Stk	47	Order-1001
DE184154	HUT_2	KK1000GR	KK1000GR-Gehäuse-Rot	0	28.08.2024 16:00	10	Stk	51	Order-1002
DE184155	HUT_2	KK1000GG	KK1000GG-Gehäuse-Grün	0	29.08.2024 16:00	11	Stk	52	Order-1002
DE184156	HUT_2	KK1000GB	KK1000GB-Gehäuse-Blau	0	30.08.2024 16:00	12	Stk	53	Order-1002
DE184157	HUT_3	KK1000GR	KK1000GR-Gehäuse-Rot	0	03.09.2024 16:00	10	Stk	57	Order-1003
DE184158	HUT_3	KK1000GG	KK1000GG-Gehäuse-Grün	0	04.09.2024 16:00	11	Stk	58	Order-1003
DE184159	HUT_3	KK1000GB	KK1000GB-Gehäuse-Blau	0	05.09.2024 16:00	12	Stk	59	Order-1003
DE184160	HUT_4	KK1000GR	KK1000GR-Gehäuse-Rot	0	09.09.2024 16:00	10	Stk	63	Order-1004
DE184161	HUT_4	KK1000GG	KK1000GG-Gehäuse-Grün	0	10.09.2024 16:00	11	Stk	64	Order-1004
DE184162	HUT_4	KK1000GB	KK1000GB-Gehäuse-Blau	0	11.09.2024 16:00	12	Stk	65	Order-1004
DE184163	HUT_5	KK1000GR	KK1000GR-Gehäuse-Rot	0	15.09.2024 16:00	10	Stk	69	Order-1005
DE184164	HUT_5	KK1000GG	KK1000GG-Gehäuse-Grün	0	16.09.2024 16:00	11	Stk	70	Order-1005
DE184165	HUT_5	KK1000GB	KK1000GB-Gehäuse-Blau	0	17.09.2024 16:00	12	Stk	71	Order-1005

DE184166	HUT_6	KK1000EMA	KK1000EMA-Elektronikmodul-A	0	18.07.2024 08:11	30	Stk	77	Order-1001
DE184167	HUT_6	KK1000EMB	KK1000EMB-Elektronikmodul-B	0	19.07.2024 08:11	30	Stk	79	Order-1001
DE184168	HUT_7	KK1000EMA	KK1000EMA-Elektronikmodul-A	0	20.07.2024 08:11	30	Stk	81	Order-1002
DE184169	HUT_7	KK1000EMB	KK1000EMB-Elektronikmodul-B	0	21.07.2024 08:11	30	Stk	83	Order-1002
DE184170	HUT_8	KK1000EMA	KK1000EMA-Elektronikmodul-A	0	22.07.2024 08:11	30	Stk	85	Order-1003
DE184171	HUT_8	KK1000EMB	KK1000EMB-Elektronikmodul-B	0	23.07.2024 08:11	30	Stk	87	Order-1003
DE184172	HUT_9	KK1000EMA	KK1000EMA-Elektronikmodul-A	0	24.07.2024 08:11	30	Stk	89	Order-1004
DE184173	HUT_9	KK1000EMB	KK1000EMB-Elektronikmodul-B	0	25.07.2024 08:11	30	Stk	91	Order-1004
DE184174	HUT_10	KK1000EMA	KK1000EMA-Elektronikmodul-A	0	26.07.2024 08:11	30	Stk	93	Order-1005
DE184175	HUT_10	KK1000EMB	KK1000EMB-Elektronikmodul-B	0	27.07.2024 08:11	30	Stk	95	Order-1005
DE184176	HUT_11	KK1000KTA	KK1000KTA-Kleinteile-A	0	18.07.2025 08:10	30	Stk	143	Order-0001
DE184177	HUT_11	KK1000KTB	KK1000KTB-Kleinteile-B	0	19.07.2025 08:10	30	Stk	145	Order-0001
DE184178	HUT_12	KK1000KTA	KK1000KTA-Kleinteile-A	0	20.07.2025 08:10	30	Stk	147	Order-0002

DE184179	HUT_12	KK1000KTB	KK1000KTB-Kleinteile-B	0	21.07.2025 08:10	30	Stk	149	Order-0002
DE184180	HUT_13	KK1000KTA	KK1000KTA-Kleinteile-A	0	22.07.2025 08:10	30	Stk	151	Order-0003
DE184181	HUT_13	KK1000KTB	KK1000KTB-Kleinteile-B	0	23.07.2025 08:10	30	Stk	153	Order-0003
DE184182	HUT_14	KK1000KTA	KK1000KTA-Kleinteile-A	0	24.07.2025 08:10	30	Stk	155	Order-0004
DE184183	HUT_14	KK1000KTB	KK1000KTB-Kleinteile-B	0	25.07.2025 08:10	30	Stk	157	Order-0004
DE184184	HUT_15	KK1000KTA	KK1000KTA-Kleinteile-A	0	26.07.2025 08:10	30	Stk	159	Order-0005
DE184185	HUT_15	KK1000KTB	KK1000KTB-Kleinteile-B	0	27.07.2025 08:10	30	Stk	161	Order-0005

Simulation result from "LOG-09"

SimulationRun

simulation_owner	simulation_description	simulation_timestamp	simulation_data_quality	simulation_run_id	simulation_comment	simulation_expiration_timestamp
LOG_NL_09	Standardsimulation	28.02.2023 09:05	High	S4	good run!	28.03.2023 13:02

Shipment

shipment_number	shipment_simulation_run	shipment_destination	shipment_destination_timestamp	shipment_recipient	shipment_recipient_timestamp_planned	shipment_splitting_allowed	shipment_logistics	shipment_preceding
NL56416510	S4	TIER-1_DE_76	24.01.2023 21:00	TIER-1_DE_76	25.01.2023 09:00	1	LOG_NL_09	

NL56416511	S4	TIER-1_DE_76	25.01.2023 21:00	TIER-1_DE_76	26.01.2023 18:00	1	LOG_NL_09	
NL56416512	S4	TIER-1_DE_76	26.01.2023 21:00	TIER-1_DE_76	27.01.2023 03:00	1	LOG_NL_09	
NL56416513	S4	TIER-1_DE_76	27.01.2023 21:00	TIER-1_DE_76	28.01.2023 12:00	1	LOG_NL_09	
NL56416514	S4	TIER-1_DE_76	28.01.2023 21:00	TIER-1_DE_76	29.01.2023 21:00	1	LOG_NL_09	

HandlingUnit

handling_unit_number	handling_unit_shipment	hut_name	handling_unit_volume	handling_unit_weight	handling_unit_amount
HUT_1	NL56416510	Pallette	1	189	1
HUT_2	NL56416511	Pallette	1	189	1
HUT_3	NL56416512	Pallette	1	189	1
HUT_4	NL56416513	Pallette	1	189	1
HUT_5	NL56416514	Pallette	1	189	1

MaterialBatch

batch_number	batch_handling_unit	material_number	material_name	material_hazardous_goods	batch_expiration_timestamp	batch_quantity	uom_name	batch_serial_number	batch_order_id
NL184151	HUT_1	KK1000DR	KK1000 DR-Deckel-Rot	0	25.08.2024 16:00	20	Stk	48	1000000
NL184152	HUT_1	KK1000DG	KK1000 DG-Deckel-Grün	0	26.08.2024 16:00	21	Stk	49	1000001
NL184153	HUT_1	KK1000DB	KK1000 DB-Deckel-Blau	0	27.08.2024 16:00	20	Stk	50	1000002
NL184154	HUT_2	KK1000DR	KK1000 DR-Deckel-Rot	0	31.08.2024 16:00	13	Stk	54	1000003
NL184155	HUT_2	KK1000DG	KK1000 DG-Deckel-Grün	0	01.09.2024 16:00	14	Stk	55	1000004
NL184156	HUT_2	KK1000DB	KK1000 DB-Deckel-Blau	0	02.09.2024 16:00	15	Stk	56	1000005

NL184157	HUT_3	KK1000DR	KK1000 DR-Deckel-Rot	0	06.09.2024 16:00	15	Stk	60	1000006
NL184158	HUT_3	KK1000DG	KK1000 DG-Deckel-Grün	0	07.09.2024 16:00	13	Stk	61	1000007
NL184159	HUT_3	KK1000DB	KK1000 DB-Deckel-Blau	0	08.09.2024 16:00	14	Stk	62	1000008
NL184160	HUT_4	KK1000DR	KK1000 DR-Deckel-Rot	0	12.09.2024 16:00	25	Stk	66	1000009
NL184161	HUT_4	KK1000DG	KK1000 DG-Deckel-Grün	0	13.09.2024 16:00	21	Stk	67	1000010
NL184162	HUT_4	KK1000DB	KK1000 DB-Deckel-Blau	0	14.09.2024 16:00	23	Stk	68	1000011
NL184163	HUT_5	KK1000DR	KK1000 DR-Deckel-Rot	0	18.09.2024 16:00	10	Stk	72	1000012
NL184164	HUT_5	KK1000DG	KK1000 DG-Deckel-Grün	0	19.09.2024 16:00	20	Stk	73	1000013
NL184165	HUT_5	KK1000DB	KK1000 DB-Deckel-Blau	0	20.09.2024 16:00	21	Stk	74	1000014

Dataset for scenario flow

Szenario initiation

Depending on the direction of the scenario (from right to left or from left to right in the network), the payload of the scenario request differs.

In the direction to the left (see "Changed delivery time window" scenario in the Use Case description section), the request contains scenario-describing information in the form of parameters. In contrast, in the direction to the right (see the "*Changed delivery times*" scenario in the Use Case description section), only simulation results from your own simulation are sent and

therefore no scenario description is provided. However, the same payload structure is used for both cases.

Payload structure

- Scenario header
- Scenario parameter
- Scenario simulation results initial
- Scenario simulation results updated

Note: The description from the Basic Flow applies to the structure of both simulation results.

JSON example for scenario "Changed delivery time window"


```
{
  "materialFlowScenarioRequest" : {
    "scenarioSimResults" : {
      "resultOwnId" : "916b5688-8bd8-4d7e-83b9-e0d40939274e",
      "resultOwnSimRunInitial" : {},
      "resultOwnSimRunUpdated" : {}
    },
    "scenarioParameter" : [{
      "unitOfMeasurement" : "KG",
      "parameterComment" : "updated Delivery Date",
      "materialName" : "KK1000GR-Gehäuse-Rot",
      "parameterQuantityUpdated" : 1.0,
      "parameterId" : "847c71e5-614a-468b-a3a0-674bf2af3004",
      "materialNumber" : "KK1000GR",
      "parameterDeliveryDateUpdated" : "2023-10-10T11:00:00.000Z",
      "parameterDeliveryDateInitial" : "2023-10-09T08:00:00.000Z",
      "parameterOrderId" : "OID-011123456",
      "parameterQuantityInitial" : 1.0
    }],
    "scenarioHeader" : {
      "scenarioOwnerRole" : "Customer",
      "scenarioCreationTimestamp" : "2023-10-04T09:10:00.000Z",
      "scenarioExpirationTimestamp" : "2023-10-07T09:10:00.000Z",
      "scenarioOwner" : "BPNL0000007OTZ3",
      "scenarioDescription" : "Please check whether the goods can be delivered in the time window between 11 a.m.
and 12 noon",
      "scenarioId" : "8d464b8b-6977-4952-8a22-0489067ca081",
      "scenarioTitle" : "Changed delivery time window"
    }
  }
}
```


JSON example for scenario "Changed delivery times"

```
{
  "materialFlowScenarioRequest" : {
    "scenarioSimResults" : {
      "resultOwnId" : "916b5688-8bd8-4d7e-83b9-e0d40939274e",
      "resultOwnSimRunInitial" : {
        "owner" : { },
        "dataQuality" : 0,
        "description" : "Please simulate asap",
        "comment" : "successful simulation",
        "expirationTimestamp" : "2023-03-24T09:15:24.000Z",
        "runId" : "0fece48b-c8d1-4180-1a9caca6d67e",
        "shipments" : [ {
          "handlingUnits" : [ {
            "name" : "Palette",
            "volume" : 1.0,
            "weight" : 189.0,
            "batches" : [ {
              "unitOfMeasurement" : "KG",
              "materialName" : "KK1000GR-Gehäuse-Rot",
              "quantity" : 50.0,
              "materialNumber" : "KK1000GR",
              "materialHazardousGoods" : false,
              "batchOrderId" : "Order-0001",
              "batchId" : "Batch_1",
              "batchExpirationTimestamp" : "2023-08-22T16:00:00.000Z",
              "batchNumber" : "45"
            } ],
            "handlingUnitId" : "HUT_1",
            "amount" : 1
          } ],
          "shipmentId" : "DE51515151",
          "recipientTimestampPlanned" : "2023-04-19T09:00:00.000Z",
          "destination" : { },
          "recipient" : { },
          "logistics" : { },
          "preceding" : { },
          "splittingAllowed" : true,
          "destinationTimestamp" : "2023-03-19T09:00:00.000Z"
        } ],
        "timestamp" : "2023-03-09T14:13:42.806Z"
      },
      "resultOwnSimRunUpdated" : {
        "owner" : { },
        "dataQuality" : 0,
        "description" : "Please simulate asap",
        "comment" : "successful simulation",
        "expirationTimestamp" : "2023-03-24T09:15:24.000Z",
        "runId" : "0fece48b-c8d1-4180-1a9caca6d67e",
        "shipments" : [ {
          "handlingUnits" : [ {
            "name" : "Palette",
```

```
          "volume" : 1.0,
          "weight" : 189.0,
          "batches" : [ {
            "unitOfMeasurement" : "KG",
            "materialName" : "KK1000GR-Gehäuse-Rot",
            "quantity" : 50.0,
            "materialNumber" : "KK1000GR",
            "materialHazardousGoods" : false,
            "batchOrderId" : "Order-0001",
            "batchId" : "Batch_1",
            "batchExpirationTimestamp" : "2023-08-22T16:00:00.000Z",
            "batchNumber" : "45"
          } ],
          "handlingUnitId" : "HUT_1",
          "amount" : 1
        } ],
        "shipmentId" : "DE51515151",
        "recipientTimestampPlanned" : "2023-04-19T09:00:00.000Z",
        "destination" : { },
        "recipient" : { },
        "logistics" : { },
        "preceding" : { },
        "splittingAllowed" : true,
        "destinationTimestamp" : "2023-03-19T14:30:00.000Z"
      } ],
      "timestamp" : "2023-03-09T14:13:42.806Z"
    }
  },
  "scenarioParameter" : [],
  "scenarioHeader" : {
    "scenarioOwnerRole" : "LogisticianSending",
    "scenarioCreationTimestamp" : "2023-10-04T09:10:00.000Z",
    "scenarioExpirationTimestamp" : "2023-10-07T09:10:00.000Z",
    "scenarioOwner" : "BPNL0000007OTZ3",
    "scenarioDescription" : "",
    "scenarioId" : "8d464b8b-6977-4952-8a22-0489067ca081",
    "scenarioTitle" : "Changed delivery times"
  }
 }
}
```


Scenario feedback

No example is required for the response to a scenario request, as the corresponding API function does not contain a payload.

Scenario state change

No example is required to change the scenario status, as the corresponding API function does not contain a payload.