

SUPPLY CHAIN DIGITAL TWIN USER GUIDE PART 2

Manual v2 - 2023-10-09
Model version 1.40.0

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1 Running a Scenario in Single Run Mode

Navigate to the simulation screen by clicking on the “Play” button at the top of the screen as seen in Figure 1 or by clicking on the simulation view in the View dropdown menu as shown in Figure 2.

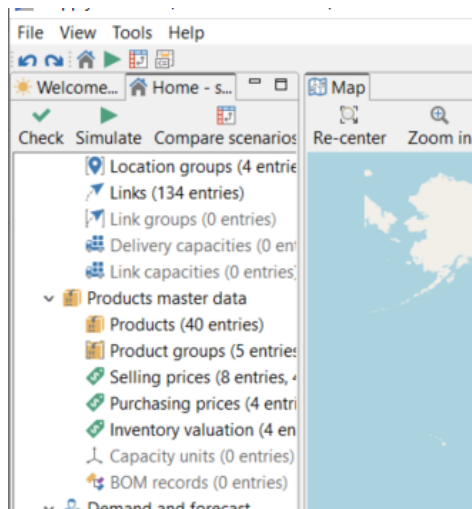


Figure 1: Top Menu Screen

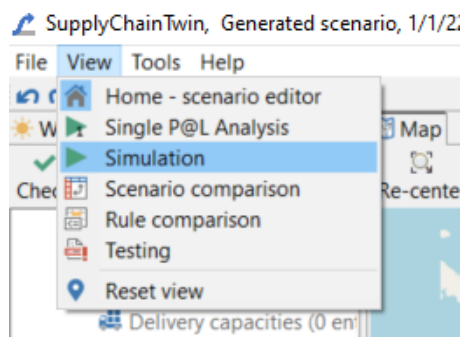


Figure 2: Top Menu Dropdown List

After clicking on the “Simulate” button, the following screen will appear (Figure 3). It might take a while to load if the scenario file is large.

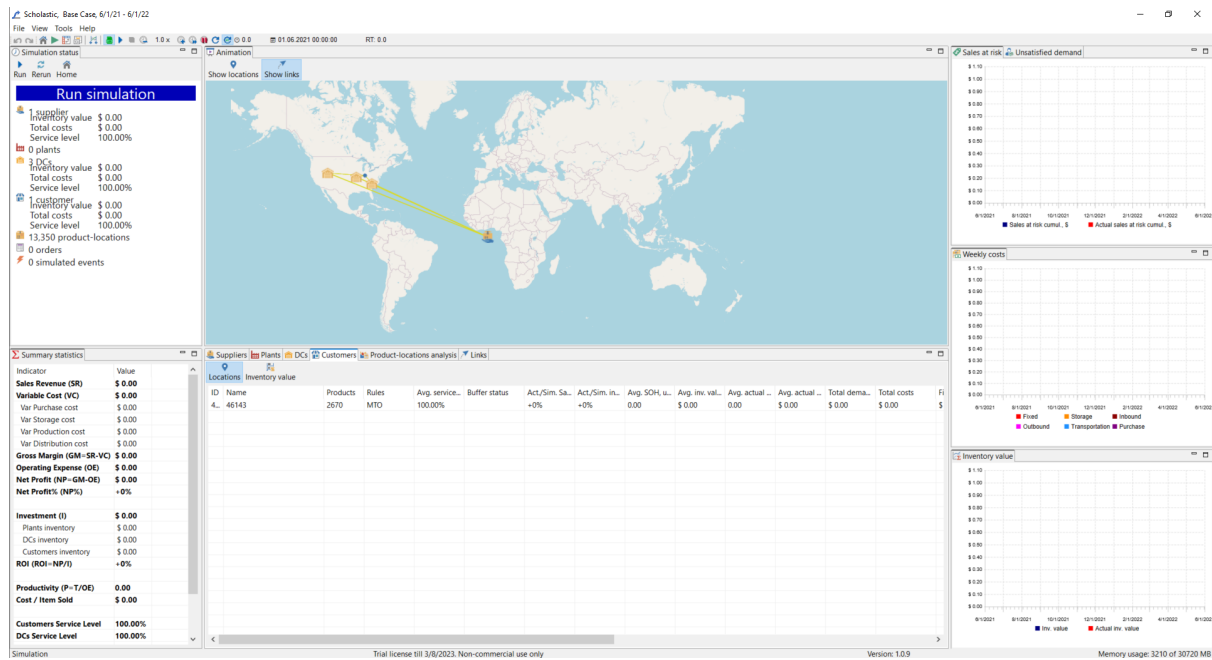


Figure 3: Simulation

The navigation at the top is shown in Figure 4.



Figure 4: Navigation bar

Row with grey background from left to right:

Undo - back arrow. Go back to the previous action.

Redo - forward arrow. Redo something that has been undone

Home - go to the scenario editor screen

Simulate - navigate to the simulation screen

Scenario comparison - navigate to the scenario comparison screen. See Section 2 for more info about the scenario comparison.

Rule comparison/analysis screen? Compare rules

Sync plots - update all the graphs according to the product-location chosen

Enable/disable logging in the console file.

Run - run the simulation

Stop - stop the simulation at the current point in time

Slower - run the simulation at a slower speed

... x - the current speed of the simulation

Faster - run the simulation at a faster speed

Fastest - run the simulation at the fastest possible speed

Schedule stop - schedule to stop the simulation at a specific point in time

Update view - update the view to reflect any changes or updates

Auto update - auto update the view to the latest and most updated view

Model time - the current time in the simulation

The simulation screen is divided into different sections in the following image for ease of reference.

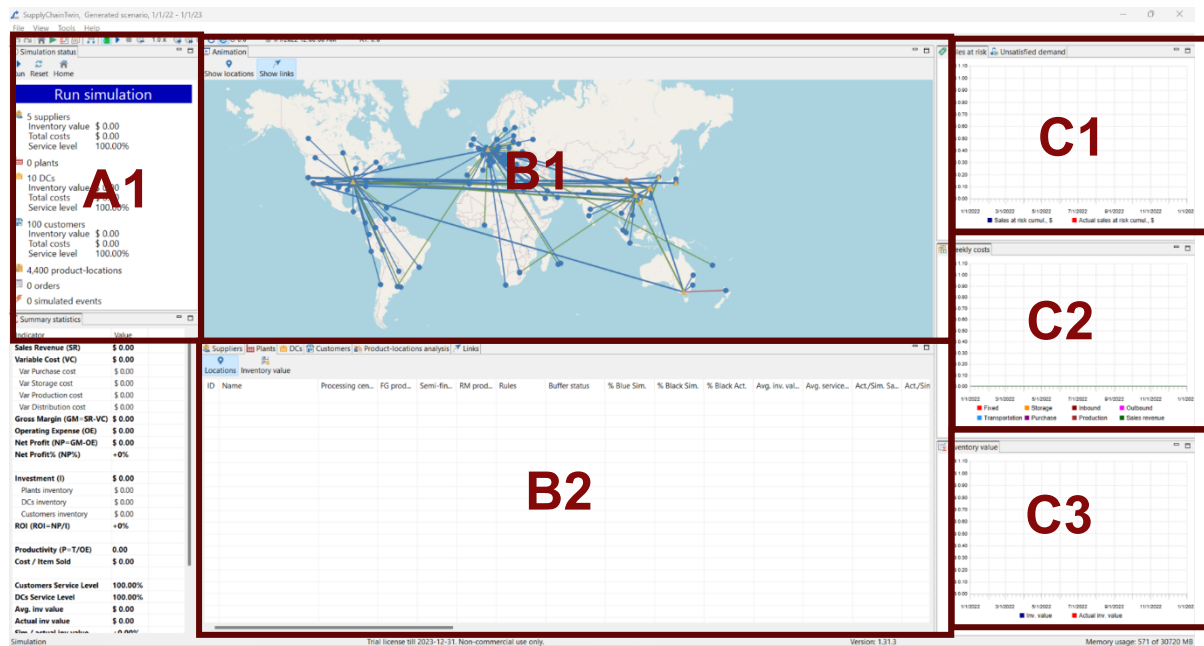
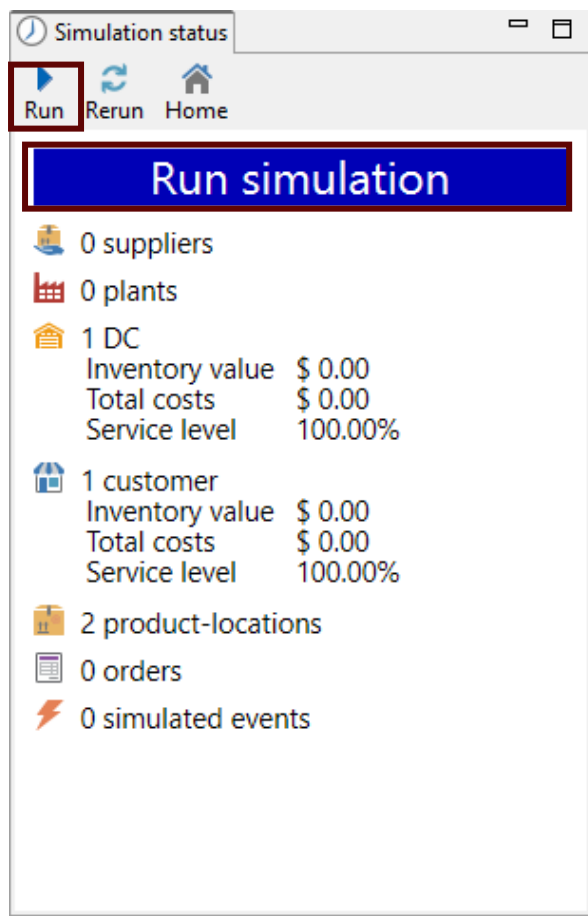


Figure 5: Simulation Sections

1.1 Simulation Status (Block A1)

In this window, an overview of the simulation is shown. The simulation can be run by clicking on the blue “Run simulation” or “Run” button.



Each of the location types is shown with the following Key Performance Indicators KPIs):

- Inventory value: This is the total inventory value accumulated during the simulation period.
- Total costs: The total costs that are accumulated during the simulation period.
- Service level: The service level is the percentage of demand that could be satisfied.
- Number of unique product-location combinations.
- Number of total orders.
- Number of simulated events.

1.2 Animation (Block B1)

The animation window is where the location of all the suppliers, customers, and DCs are displayed, as well as the links between them. Move the map by right-clicking on the map and then moving the mouse. When clicking on each of the location icons, more information will pop up as shown below:

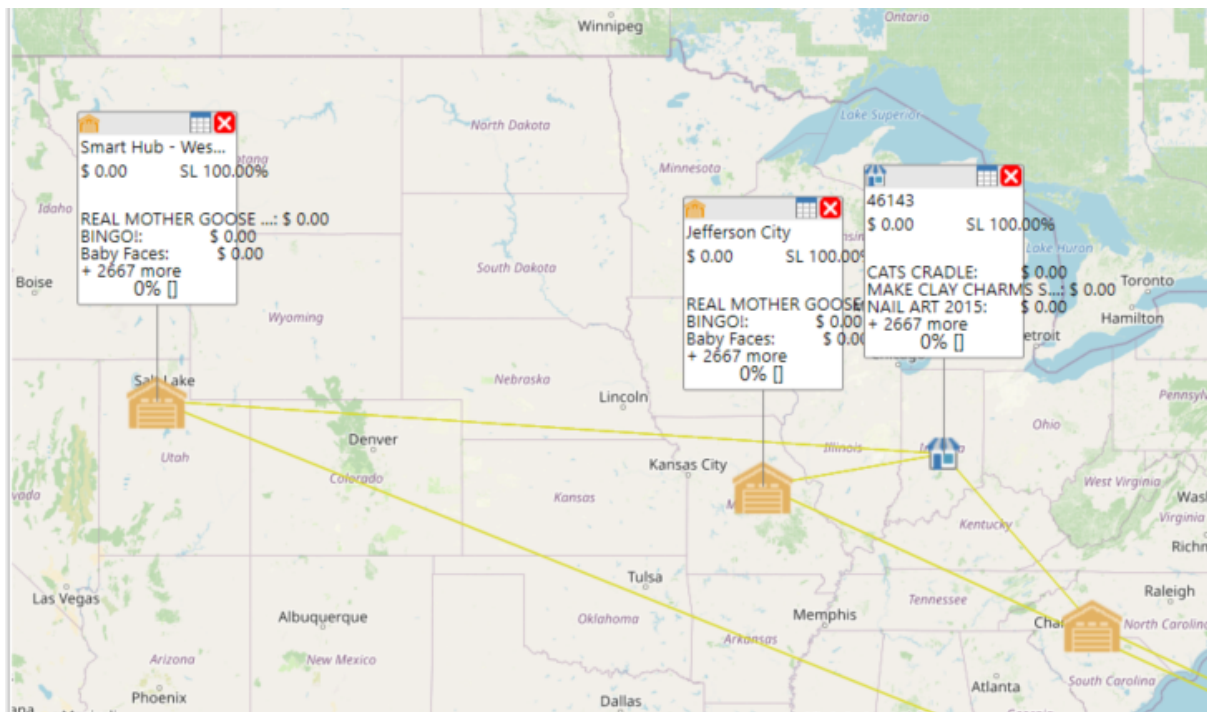


Figure 6: Animation Screen

When clicking on the table icon, it will open the relevant location information in the window below.

1.3 Locations & Links (Block B2)

In this window, the Supplier, Plants, DCs, Customers, product-locations, and Links tabs can be seen on your screen. The Plants tab can be ignored for now and will be removed in the future.

Column heading	Description	Example
FG products	Total number of finished goods (FG) products. FG product is a final product that is produced at the plant and can be shipped from its external location	10
Semi-finished products	Total number of products that are both produced at some processing center of the plant and used as input for some other processing center of the same plant. Semi-finished products can be shipped to external locations.	10
RM products	Total number of products that are sourced from external locations to be used as raw materials (RM) at this plant	200
Rules	The rule that is associated with this specific location.	MTO
Avg. service level	The demand that could be satisfied as a percentage of total demand.	100%
Total demand value	The total units of the selected product ordered from the DC during the simulation period.	200
Total costs	The total costs associated with the particular location.	\$10000.00
Fixed costs	Business costs, such as rent, that are constant whatever the number of goods produced.	\$6500
Inbound costs	Inbound shipping costs refer to delivery of goods cost borne by a company.	\$4560
Outbound costs	Outbound Costs means any outbound costs associated with the delivery of Product including costs related to cold storage shipping containers and external storage (if required) of Product, such costs including freight, duty, insurance, and warehousing.	\$3000
Storage costs	Storage costs are the amount of money incurred because of storing inventory.	\$4000

Column heading	Description	Example
Groups	The groups that this location is a part of in a comma-separated list.	All Locations, CLT

1.3.3 DCs

Column heading	Description	Example
ID	This is the ID of the location. It is unique across all source locations, i.e., it cannot be duplicated in the column.	S
Name	The name of the location.	Supplier
Products	The number of products linked to this specific location.	2645
Rules	The rule that is associated with this specific location.	MTO
Avg. service level	The demand that could be satisfied as a percentage of total demand.	100%
Total demand value	The total units of the selected product ordered from the DC during the simulation period.	200
Total costs	The total costs associated with the particular location.	\$10000.00
Fixed costs	Business costs, such as rent, that are constant whatever the number of goods produced.	\$6500
Inbound costs	Inbound shipping costs refer to delivery of goods cost borne by a company.	\$4560
Outbound costs	Outbound Costs means any outbound costs associated with the delivery of Product including costs related to cold storage shipping containers and external storage (if required) of Product, such costs including freight, duty, insurance, and warehousing.	\$3000

Column heading	Description	Example
Storage costs	Storage costs are the amount of money incurred because of storing inventory.	\$4000
Groups	The groups that this location is a part of in a comma-separated list.	All Locations, CLT

1.3.4 Customers

Column heading	Description	Example
ID	This is the ID of the location. It is unique across all source locations, i.e., it cannot be duplicated in the column.	S
Name	The name of the location.	Supplier
Products	The number of products linked to this specific location.	2645
Rules	The rule that is associated with this specific location.	MTO
Avg. service level	The demand that could be satisfied as a percentage of total demand.	100%
Total demand	The total units of the selected product ordered by the Customer during the simulation period.	25
Groups	The groups that this location is a part of in a comma-separated list.	All Customers, CLT

1.3.5 Product-locations

Column heading	Description	Example
Product	The name of the product.	Product-0
Location	The name of the location.	Supplier
Service level	The demand that could be satisfied as a percentage of total demand.	100%

Column heading	Description	Example
Inv turns per year	Inventory turnover measures how efficiently a company uses its inventory by dividing the cost of goods sold by the average inventory value in a year.	4.05
Avg SOH, units	The average number of product units of the selected product in stock during the year.	112
Avg actual SOH, units	The actual stock on hand that has been added to the input sheet (from past data).	112
Total demand, value	The total demand value of the specified product at the specified location during the specified simulation period.	450
Total receipts, units	The total units of the specified product received at the specified location during the specified simulation period.	430
Total issues, units	The total units of the specified product issued at the specified location during the specified simulation period.	430
Unsatisfied demand, units	The total number of demanded units of the specified product issued at the specified location during the specified simulation period that could not be issued.	20
Monthly demand variability	How much the max/min monthly demand deviates from the average monthly demand.	59%
Daily demand variability	How much the max/min daily demand deviates from the average daily demand.	87%
Average lead time, days	The average amount of days between ordering products from upstream and receiving the products downstream.	5
Max lead time, days	The maximum number of days between ordering products from upstream and receiving the products downstream	12
Lead time variability	How much the max/min Lead time deviates from the Average lead time.	0%
Total costs	The sum of inbound, outbound, storage, and purchase costs.	\$1000
Inbound costs	Inbound shipping costs refer to delivery of goods cost borne by a company.	\$250

Column heading	Description	Example
Outbound costs	Outbound Costs means any outbound costs associated with the delivery of Product including costs related to cold storage shipping containers and external storage (if required) of the product, such costs including freight, duty, insurance, and warehousing.	\$500
Storage costs	Storage costs are the amount of money incurred because of storing inventory.	\$250
Groups	The groups that this location is a part of in a comma-separated list.	All products

Plots have the following options to choose from for the x- and y-axis:

- Demand in units
- Demand variability
- Lead time in days
- Lead time variability
- Service level
- Inventory turns/year
- Cost

1.3.6 Links

Column Heading	Description	Example
ID	This is the ID of the link as defined in the input sheet.	Link-S-JC-
Name	The name of the link as defined in the scenario file.	Link-S-JC-
Source	The location that is used to supply products to the destination location.	S
Dest	The location where products are received from a source location.	JC

Column Heading	Description	Example
Deliveries en route	The number of deliveries that are part of the specified link.	5
Planned transp. lead time, days	The planned amount of time from when a product is ordered until it is delivered.	3
Avg. transp. lead time, days	The average time it takes from when a product is ordered until it is delivered.	4
Total deliveries	The total number of deliveries that took place during the simulation period.	3581
Avg. load factor, %	The average load factor is the average percentage of how full a vehicle is on this link.	70%
Total costs, \$	Total costs associated with the specified link.	\$386
Avg cost per delivery, \$	The total costs for the link divided by the number of deliveries.	\$2.30
Conveyed, unit of product	The number of products that have been transported on this link.	60

1.3.7 Open Location or Product details

To open Location or Product specific details, the steps for all tabs will be the same.

Step 1: Navigate to the tab you want to see more detail of. In this example, we want to view the Customer details (Figure 8).

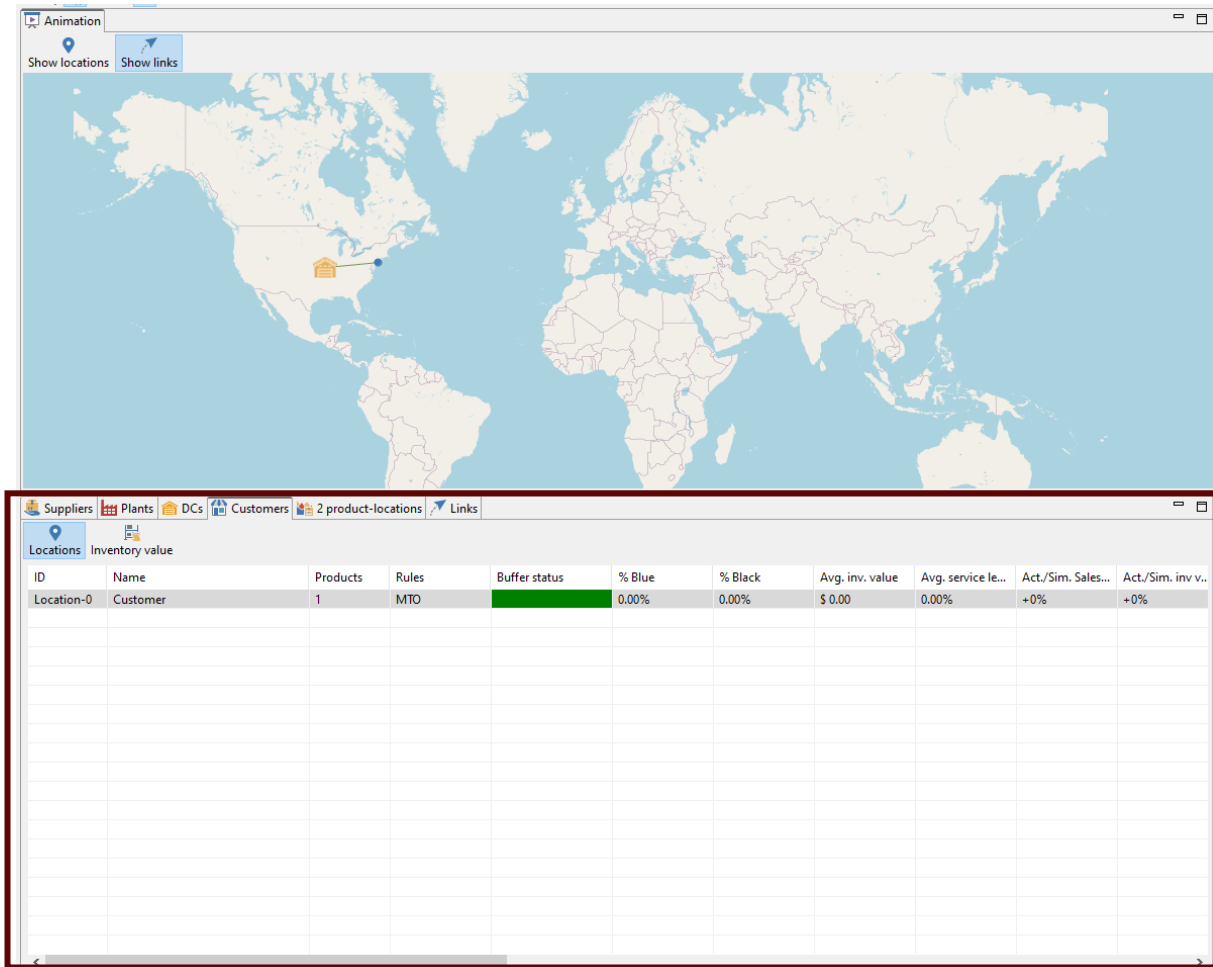


Figure 8: Customer Details Step 1

Step 2: Double-click on the row you want to see in more detail. A screen will appear in the B1 block (Figure 9).

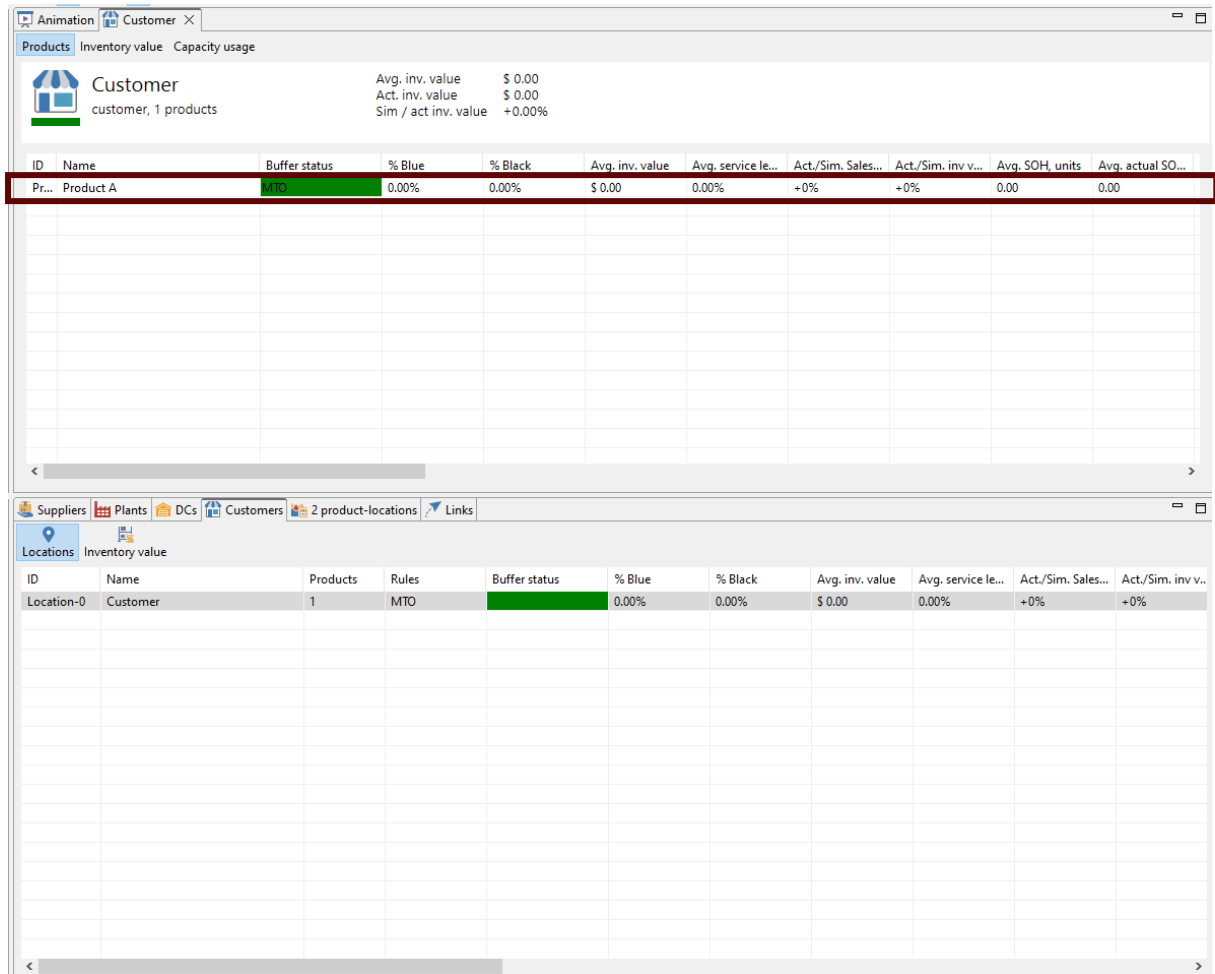


Figure 10: Customer Details Step 3

Step 4: A graph will appear with the product information. The legend of the graph is at the bottom and greyed out. You can select it to display on the graph (Figure 11).

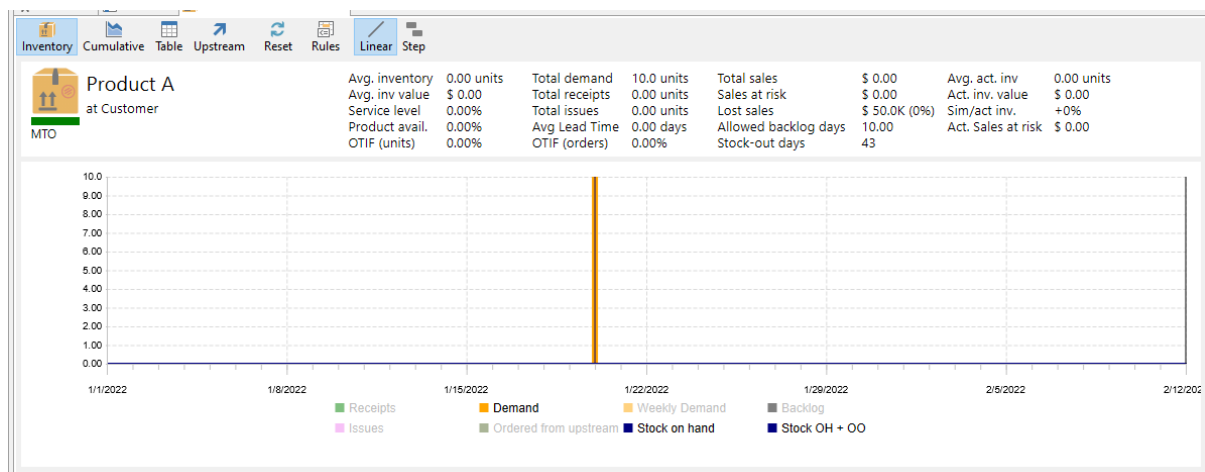


Figure 11: Product Table

The tables below will explain the legends and the dashboard statistics. It is displayed in a combination of lines and bars.

Legend

Column heading	Description	Display on Graph
Receipts	The number of product units received on the specified day.	Bar chart
Demand	The number of product units demanded by the specified location on the specified day.	Bar chart
Weekly Demand	The average weekly demand.	Line graph
Backlog	Backlog each day. It is shown cumulatively	Line graph
Issues	The number of product units issued on the specified day.	Bar chart
Ordered from Upstream	The number of product units ordered from upstream on the specified day.	Bar chart
Stock on Hand	The number of product units in stock.	Line graph
Stock OH + OO	The number of product units in stock plus product units ordered.	Line graph

1.3.8 Dashboard Values

Column heading	Description
Avg. inventory	The average inventory throughout the simulation period
Avg. inv value	The value of the average inventory throughout the simulation period
Service level	The total demand divided by the total issues in the simulation period. A higher service level means that more demand is satisfied.
Product avail.	A retailer's ability to meet customer demand at the time a product is demanded. No backlog days were used.
OTIF (units)	The fraction of orders that can be fulfilled on time and in full from the stock on hand.

Column heading	Description
Total demand	The total product units demanded throughout the whole simulation period.
Total receipts	The total amount of product units received throughout the whole simulation period.
Total issues	The total issued product units throughout the whole simulation period.
Avg Lead Time	the average amount of days it took from placing an order on upstream to receiving the order.
OTIF (orders)	The percentage of orders that are fulfilled on time and in full.
Total Sales	The total income from product units sold throughout the whole simulation period.
Sales at Risk	The total income that could have been lost due to product units demanded that could not be satisfied immediately throughout the whole simulation period.
Lost Sales	The total income that was lost due to product units demanded that could not be satisfied after the backlog period passed throughout the whole simulation period.
Allowed backlog days	The amount of time demand can wait to be satisfied after being ordered before it is a lost sale.
Stock out days	Days that no stock is available.
Avg. act. Inv	The average actual inventory throughout the simulation period.
Act. Inv. Value	The value of the actual average inventory throughout the simulation period.
Sim/act inv.	The simulated inventory divided by the actual inventory
Act. Sales at risk	The actual total income that was lost due to product units demanded that could not be satisfied immediately throughout the whole simulation period.

1.4 Unsatisfied demand (Block C1)

This chart displays the sales at risk and unsatisfied demand for all products (Figure 12).

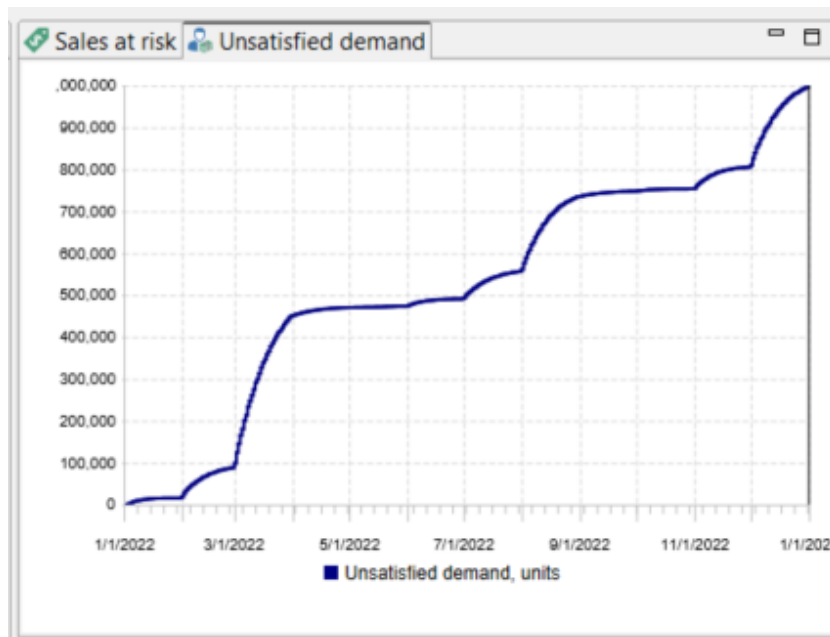


Figure 12: Unsatisfied Demand

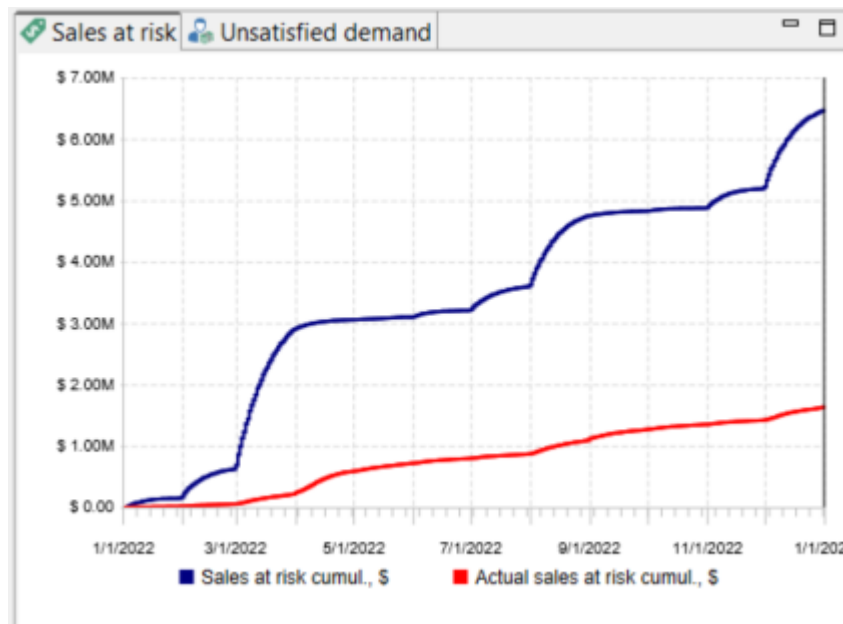


Figure 13: Sales at Risk

1.5 Weekly costs (Block C2)

This chart shows the weekly costs over the simulation period. The details of the legend can be seen in the table below.

Column heading	Description
Fixed	The fixed cost paid for all deliveries per week.

Column heading	Description
Storage	Storage cost per capacity unit per week.
Inbound	The fixed inbound costs per capacity unit per week.
Outbound	The fixed outbound costs per capacity unit per week.
Transportation	Weekly transportation costs. The cost will depend on the mode of transportation used.
Purchase	Weekly purchase costs associated with the acquisition of inventory.
Sales revenue	The gross income produced through sales per week.

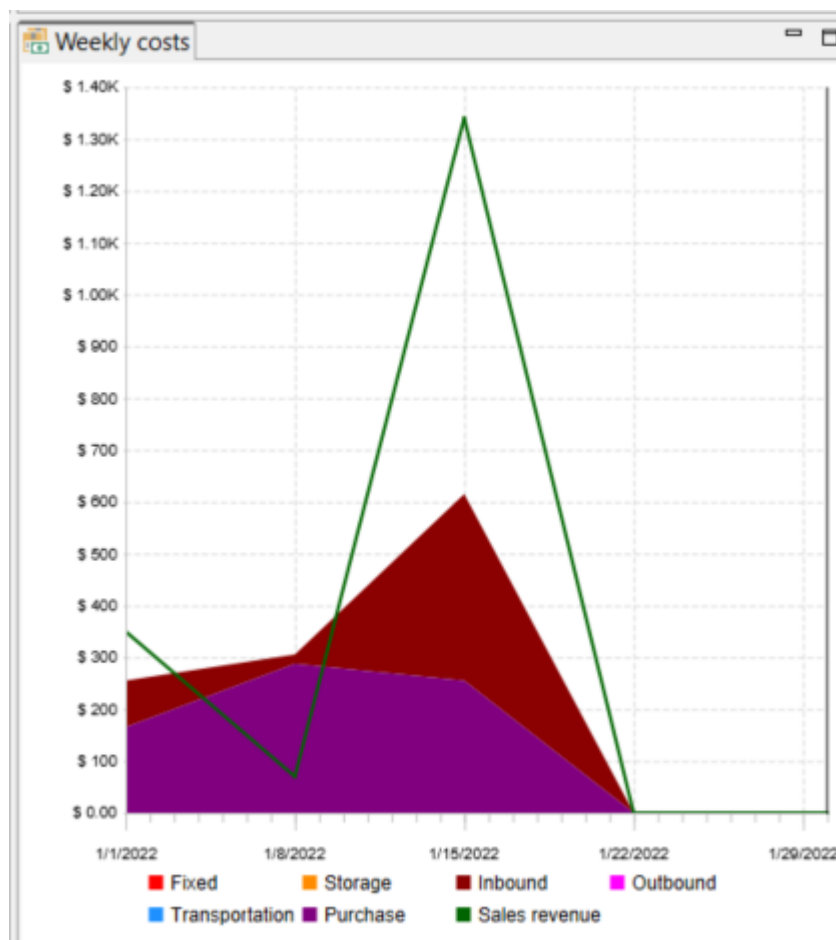


Figure 14: Weekly Costs

1.6 Inventory Value (Block C3)

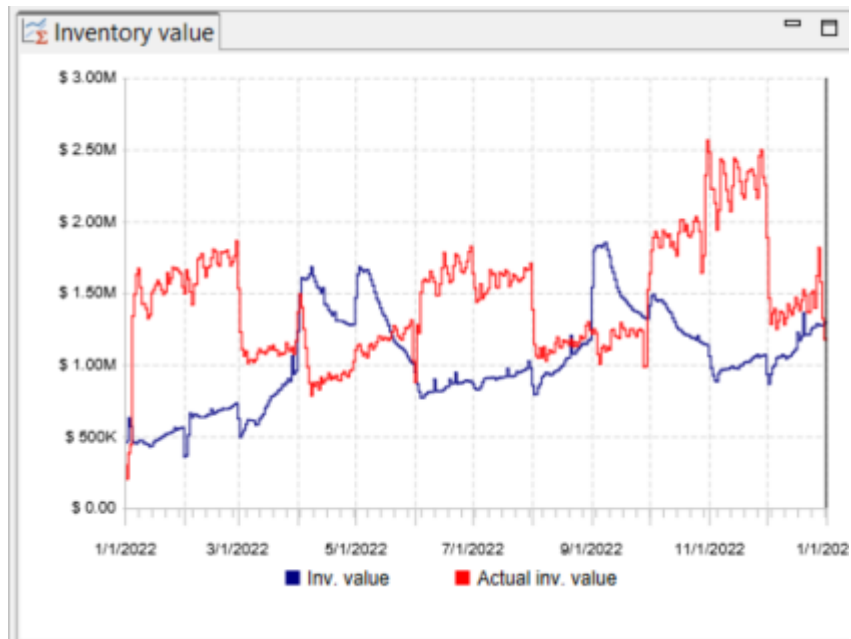


Figure 15: Inventory value

2 Running Scenario Comparison

The scenario comparison mode is where the performance of different scenarios can be compared.

Various actions can be taken using the ribbon at the top. See Figure 16.

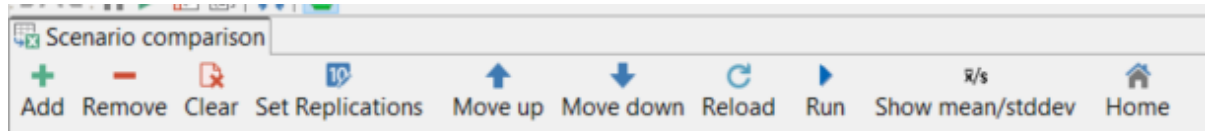


Figure 16: Scenario Comparison Banner

The banner consists of the following buttons:

- Add: Add another scenario for comparison
- Remove: Remove the selected scenario
- Clear: clear the scenario comparison screen to start from scratch.
- Set Replications: Set the number of times each scenario should be run. The more replications, the more likely the outcome will be because of the reduction in randomness.
- Move up: Move the selected scenario up.
- Move down: Move the selected scenario down in the list.
- Reload: Upload the scenarios again.
- Run: Simulate the scenarios and run the replications.
- Show mean/stddev: Show the mean or the standard deviation as a value or percentage to make it easier to compare.
- Home: Navigate back to the home scenario editor screen.

2.1 Scenario comparison

Column heading	Description	Example
Index	This is the index of the scenario and is numbered from 1 onwards.	1
Scenario name	The name of the scenario as defined in the input sheet.	Scholastic scenario A
Run status	The number of runs completed for the scenario.	0 / 1
Customer Service Level	The percentage of demand that could be satisfied at the customers.	99%
DCs Service level	The percentage of demand that could be satisfied at the DCs.	100%

Column heading	Description	Example
Avg. inv value	The total inventory value divided by the number of days in the simulation period.	\$5657
Inv. Turns per year	Inventory turns measure how efficiently a company uses its inventory by dividing the cost of goods sold by the average inventory value in a year.	4.05
File	The name of the scenario file.	Scholastic Phase 1

2.2 Unsatisfied demand

The unsatisfied demand graph displays the unsatisfied demand over the simulation period per scenario. See Figure 17.

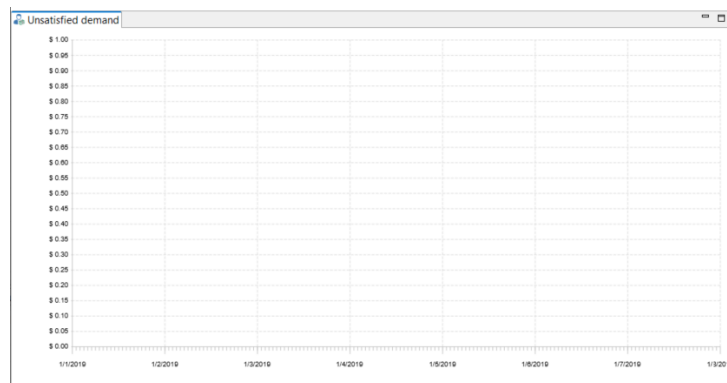


Figure 17: Unsatisfied Demand

2.3 Links

The links window shows all the information relevant to the links for the relevant scenario, refer to Figure 18.

Column Heading	Description	Example
ID	This is the ID of the link as defined in the input sheet.	Link-S-JC-
Name	The name of the link as defined in the scenario file.	Link-S-JC-
Source	The location that is used to supply products to the destination location.	S

[illegible]

3 Exporting the results and log files

The results are automatically recorded in the log files when logging is enabled. See the following Figure 19:

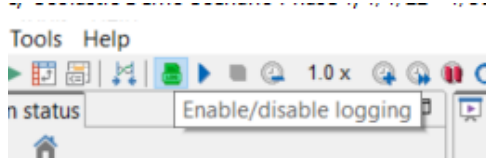


Figure 19: Enable/Disable Logging

The logging settings can be changed by clicking on Tools -> Logging settings (Figure 20).

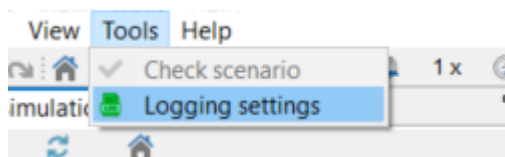


Figure 20: Change Logging Settings

The following window will pop up as shown in Figure 21.

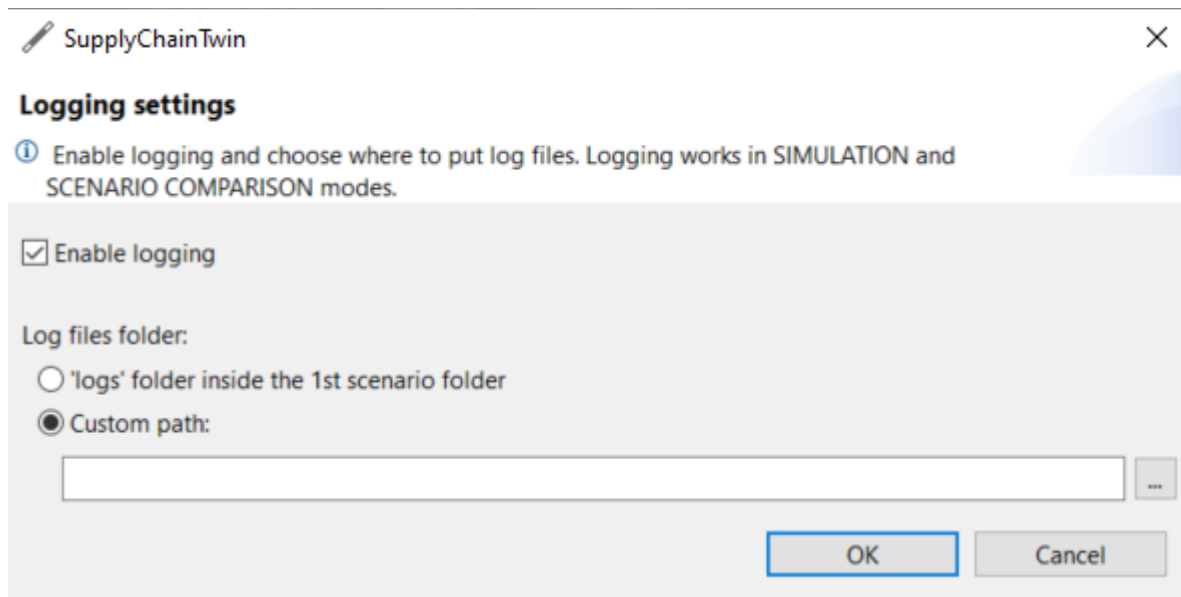


Figure 21: Logging Settings

The logs will automatically be saved inside the 1st scenario folder, but a custom path can also be selected.

The following log files will be saved in the specified file location:

- Deliveries
- DeliveriesEnRoute
- DeliveryCapacityUsage
- DeliveryContents
- DeliveryCustomerId

- OrderConsolidationTime
- OrdersWaitingForConsolidationAtEnd

Each of these files and their columns are described in the tables below.

3.1.1 Deliveries

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed used to generate the randomness in the model.	0
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Source Location Id	The ID of the location from which the delivery is supplied as specified in the input sheet.	JC
Dest Location Id	The ID of the location to which the delivery is delivered, as specified in the input sheet.	SH-W
Link Id	The ID of the link between the source and destination locations, as specified in the input sheet.	Link-124947-JC--FTL
Shipped Time	The time (day) in the model at which the delivery was shipped.	15
Arrived Time	The model time (day) at which the delivery arrived at the destination location.	16
Duration	The number of days it took from when the delivery was shipped until when it arrived. It is the difference between the arrival time and the shipping time.	1
Cost	The dollar amount of what the specific delivery cost.	1413.134
Average Load Factor	The fraction of space in the vehicle that was used.	0.767

Column heading	Description	Example
Orders	The number of orders that were associated with this delivery.	38
Units	The number of products that are delivered in a specific delivery.	159997

3.1.2 DeliveriesEnRoute

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Order Id	The ID of the order that is associated with this specific delivery.	1398442611
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Source location Id	The ID of the location from which the delivery is supplied as specified in the input sheet.	JC
Dest location Id	The ID of the location to which the delivery is delivered, as specified in the input sheet.	SH-W
Link Id	The ID of the link between the source and destination locations, as specified in the input sheet.	Link-124947-JC--FTL
Product Id	The product ID of the product that was delivered.	821679
Order placed time	The time at which the order was placed in the model.	323
Order shipped time	The time at which the order was shipped from the source location.	364

Column heading	Description	Example
Order consolidation duration	The total time it took to consolidate the order. It is the difference between the order shipped time and the order placed time.	41
Quantity	The quantity of the specified product that was delivered.	3

3.1.3 DeliveryCapacityUsage

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Capacity Unit	The unit on which the capacity was determined. It is either Weight or Volume.	Weight
Used Capacity	The capacity that was used in the number of units specified above.	43999.9
Load Factor	The fraction of how much the vehicle was loaded.	1

3.1.4 DeliveryContents

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound

Column heading	Description	Example
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Product Id	The ID of the product that was delivered as specified in the input sheet.	732626
Quantity	The quantity of the specified product that was delivered.	3

3.1.5 DeliveryCustomerId

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Customer Id	The ID of the customer that the order is associated with.	1

3.1.6 OrderConsolidationTime

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Order Id	The ID of the order that was consolidated.	1220988270
Delivery Id	The ID that is associated with the specific delivery. It is assigned by the model and starts counting from 0 onwards to number the deliveries.	0
Source location Id	The ID of the location from which the delivery is supplied as specified in the input sheet.	JC
Dest location Id	The ID of the location to which the delivery is delivered, as specified in the input sheet.	SH-W
Link Id	The ID of the link between the source and destination locations, as specified in the input sheet.	Link-124947-JC--FTL
Product Id	The ID of the product that was delivered as specified in the input sheet.	732626
Order placed time	The time at which the order was placed in the model.	323
Order shipped time	The time at which the order was shipped from the source location.	364
Order consolidation duration	The total time it took to consolidate the order. It is the difference between the order shipped time and the order placed time.	41

3.1.7 OrdersWaitingForConsolidationAtEnd

Column heading	Description	Example
Scenario file name	The name of the scenario file that was uploaded and simulated.	NSO2 Smart Hubs - Inbound

Column heading	Description	Example
Scenario name	Scenario name as specified in the input sheet.	Base Case
Seed	The random seed that was used to generate the randomness in the model.	0
Location Id	The ID of the location at which the orders are waiting for consolidation.	124673
Product Id	The ID of the product that is associated with the order as specified in the input sheet.	732626
Destination Id	The ID of the location to which the order should be delivered, as specified in the input sheet.	SH-W
Quantity	The units of product that are part of this order.	208
Placement time	The time at which the order was placed.	350
Waiting time	The amount of time that has passed since the order was placed.	14
Expiration period	The expiration date of the order. It will show "NaN" if there is no expiration date.	
Customer Id	The ID of the customer that the order is associated with.	1

4 Running Single Product at Location

To use the Single Product at Location Analysis, first select a specific product and location in the “Property” tab (Figure 22) in the Scenario Editor. Navigate to “View” and select “Single P@L Analysis” (Figure 23).

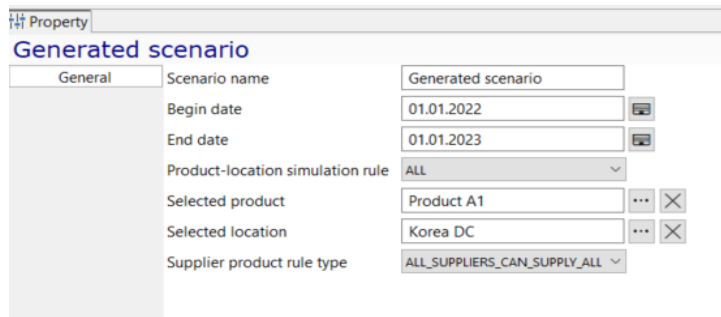


Figure 22: Generate Single P@L Analysis

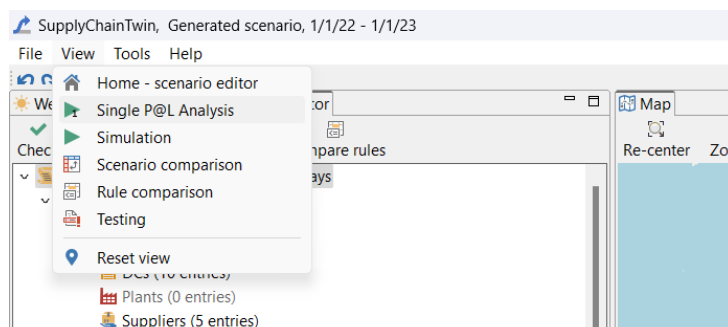


Figure 23: Select Single P@L Analysis

If a specific product and location have not been selected, you will see the following error message (Figure 24):

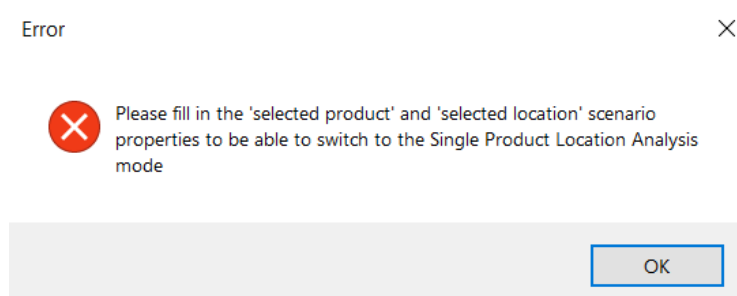


Figure 24: Product Location Error

The Single P@L analysis view has the following windows (see Figure 25):

- General settings
- Inventory graph (single product-location)
- Demand
- Known demand

- Forecast
- Demand vs Forecast

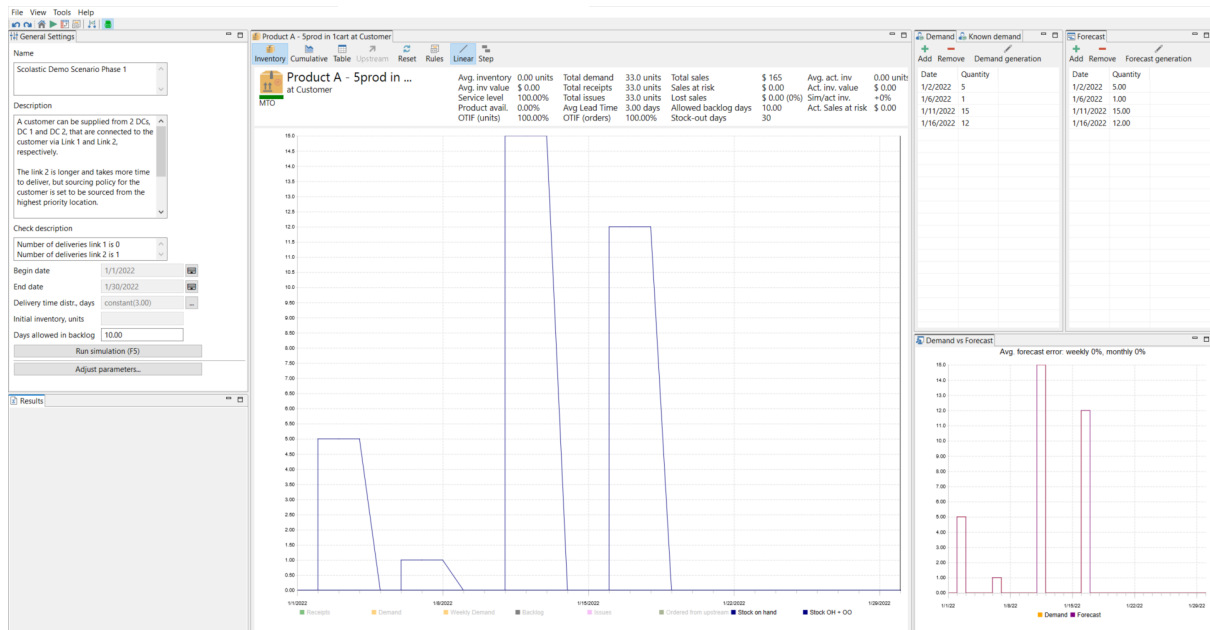


Figure 25: P@L Analysis View

4.1 General settings

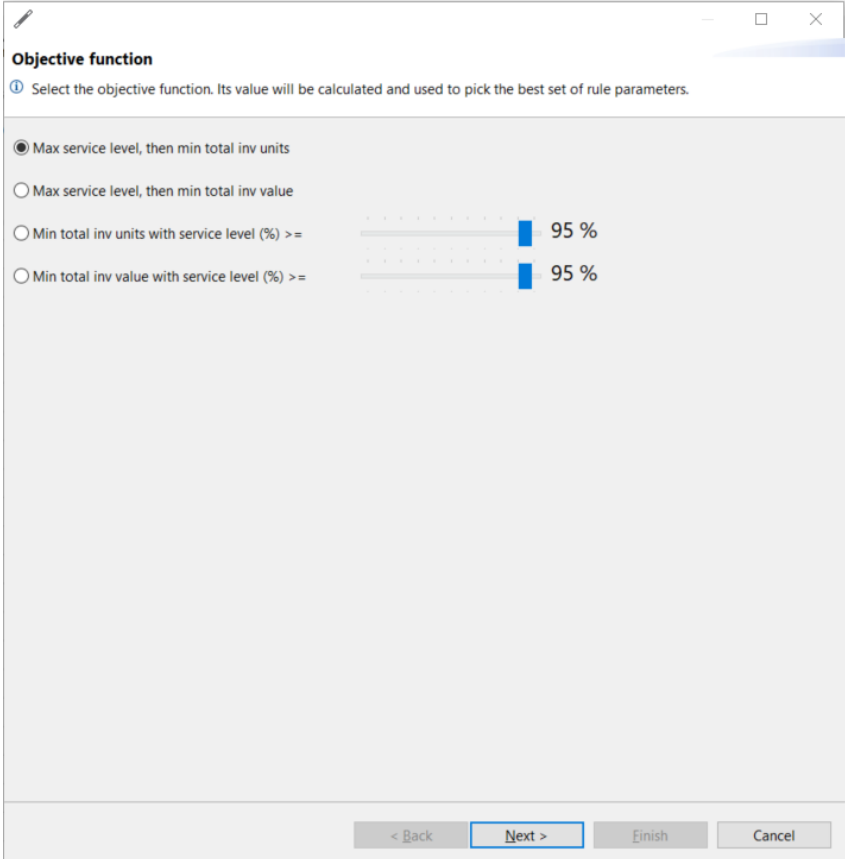
Here you can view all the settings relevant to the selected product and location combination (Figure 26). It includes the start and end dates, delivery time distribution, initial inventory (in units), and the number of days allowed in backlog. All of these parameters can be changed/adjusted. Run the simulation by clicking on the “Run simulation” button or by using the F5 button on your computer.

Figure 26: General settings

A description of the parameters can be seen in the following table.

Column name in SCDT App	Description	Example
Name	The scenario name that is specified in the input sheet.	Base Case
Description	A description of the created scenario. It has no impact on the logic of the model.	This scenario contains 2 customers with 1 DC with a lead time of 5 days.
Check description	A specific expected outcome value. It can be used to check assumptions and help prove or disprove a user's hypothesis. It has no impact on the logic of the model.	A delivery of 5 units is expected on day 4.
Begin date	The date on which the simulation starts modeling.	2021/06/01
End date	The date on which the simulation stops modeling.	2022/06/01
Delivery time distr., days	The distribution of lead time that a delivery takes after an order is placed.	Constant(3.00)
Initial inventory, units	The initial number of product units in stock at the specified location.	1416
Days allowed in backlog	The number of days an order can spend in the backlog before it is canceled, and the unfulfilled order is marked as a stockout.	100

The “Adjust parameters” button will pop up the scenario wizard screen and will allow you to select an objective function (see Figure 27) and will calculate the best set of rule parameters based on your selection.



The image shows a software window titled "Objective function" with a standard Windows-style title bar (minimize, maximize, close buttons). Below the title bar, there is a header section with the title "Objective function" and a sub-header "Select the objective function. Its value will be calculated and used to pick the best set of rule parameters." Below this, there are four radio button options for selecting an objective function. The first option, "Max service level, then min total inv units", is selected. The second option is "Max service level, then min total inv value". The third option is "Min total inv units with service level (%) > =", which has a slider bar set to 95%. The fourth option is "Min total inv value with service level (%) > =", which also has a slider bar set to 95%. At the bottom of the window, there are four buttons: "< Back", "Next >", "Finish", and "Cancel". The "Next >" button is highlighted with a blue border.

Objective function

Select the objective function. Its value will be calculated and used to pick the best set of rule parameters.

☒ Max service level, then min total inv units

☐ Max service level, then min total inv value

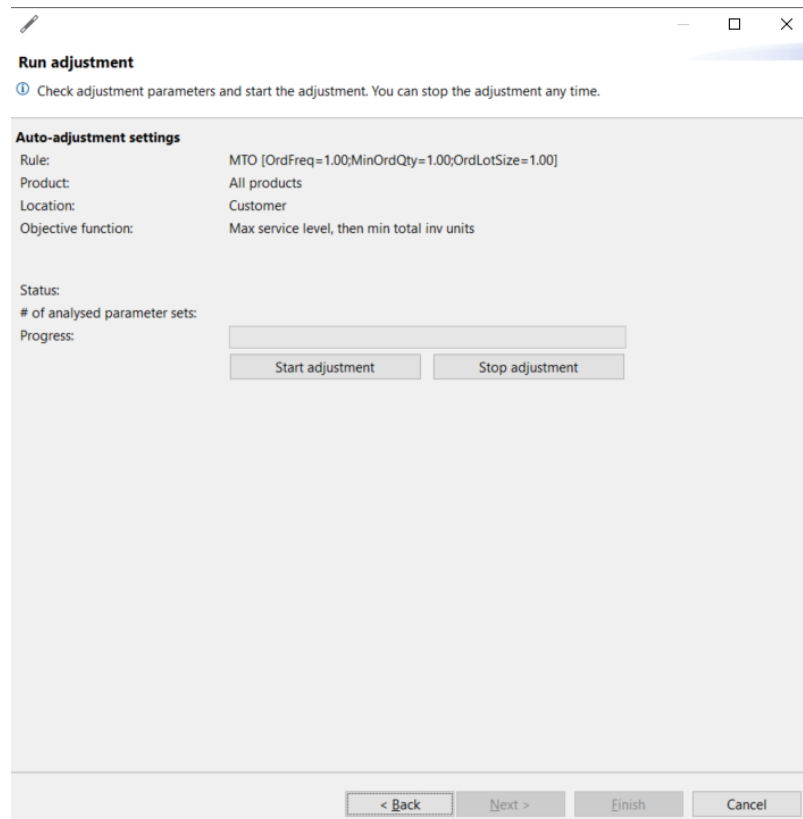
☐ Min total inv units with service level (%) > = 95 %

☐ Min total inv value with service level (%) > = 95 %

< Back Next > Finish Cancel

Figure 27: Objective Function

When you click on Next, it will navigate to the “Run adjustment” screen (see Figure 28) where you can start and stop the adjustment, and view the progress of the adjustment.



The image shows a software window titled "Run adjustment". At the top, there is a help icon and a close button. Below the title bar, a message states: "Check adjustment parameters and start the adjustment. You can stop the adjustment any time." The main area is titled "Auto-adjustment settings" and contains a table of parameters:

Auto-adjustment settings	
Rule:	MTO [OrdFreq=1.00;MinOrdQty=1.00;OrdLotSize=1.00]
Product:	All products
Location:	Customer
Objective function:	Max service level, then min total inv units

Below the table, there are labels for "Status:", "# of analysed parameter sets:", and "Progress:", each followed by an empty text box. Under the "Progress" label, there are two buttons: "Start adjustment" and "Stop adjustment". At the bottom of the window, there are four buttons: "< Back", "Next >", "Finish", and "Cancel".

Figure 28: Run Adjustment

4.2 Inventory graph (single product-location)

The inventory graph visually shows information that is relevant to inventory. The inventory graph is the window on the P@L simulation screen. Key Performance Indicators (KPIs) are shown above the graph view. The graph view can be set to inventory view, cumulative view, or table view. The rules for the specific product-location combination can also be shown by clicking on the Rules button at the top. The inventory graph is shown in Figure 29.

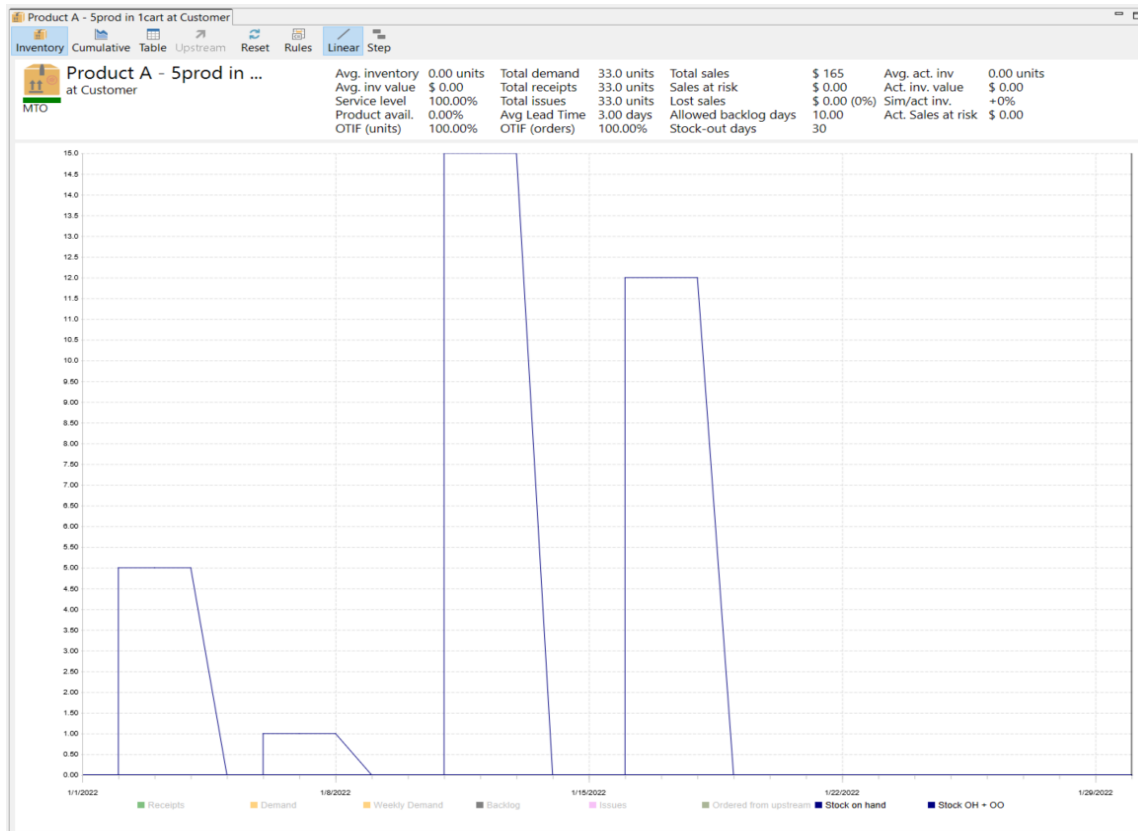


Figure 29: Inventory Graph

The KPIs on the inventory graph are explained in the following tables.

4.3 Legend

Column heading	Description	Display on Graph	
Receipts	The number of product units received on the specified day.	Bar	chart
Demand	The number of product units demanded by the specified location on the specified day.	Bar	chart
Weekly Demand	The average weekly demand.	Line	graph
Backlog	Backlog each day. It is shown cumulatively	Line graph	
Issues	The number of product units issued on the specified day.	Bar	chart

Column heading	Description	Display on Graph
Ordered from Upstream	The number of product units ordered from upstream on the specified day.	Bar chart
Stock on Hand	The number of product units in stock.	Line graph
Stock OH + OO	The number of product units in stock plus product units ordered.	Line graph

4.4 Dashboard Values

Column heading	Description
Avg. inventory	The average inventory throughout the simulation period
Avg. inv value	The value of the average inventory throughout the simulation period
Service level	The total demand divided by the total issues in the simulation period. A higher service level means that more demand is satisfied.
Product avail.	A retailer's ability to meet customer demand at the time a product is demanded. No backlog days were used.
OTIF (units)	The fraction of orders that can be fulfilled on time and in full from the stock on hand.
Total demand	The total product units demanded throughout the whole simulation period.
Total receipts	The total amount of product units received throughout the whole simulation period.
Total issues	The total issued product units throughout the whole simulation period.
Avg Lead Time	the average amount of days it took from placing an order on upstream to receiving the order.
OTIF (orders)	The percentage of orders that are fulfilled on time and in full.
Total Sales	The total income from product units sold throughout the whole simulation period.

Column heading	Description
Sales at Risk	The total income that could have been lost due to product units demanded that could not be satisfied immediately throughout the whole simulation period.
Lost Sales	The total income that was lost due to product units demanded that could not be satisfied after the backlog period passed throughout the whole simulation period.
Allowed backlog days	The amount of time demand can wait to be satisfied after being ordered before it is a lost sale.
Stock out days	Days that no stock is available.
Avg. act. Inv	The average actual inventory throughout the simulation period.
Act. Inv. Value	The value of the actual average inventory throughout the simulation period.
Sim/act inv.	The simulated inventory divided by the actual inventory
Act. Sales at risk	The actual total income that was lost due to product units demanded that could not be satisfied immediately throughout the whole simulation period.

The cumulative view of the inventory graph can be seen in Figure 30.

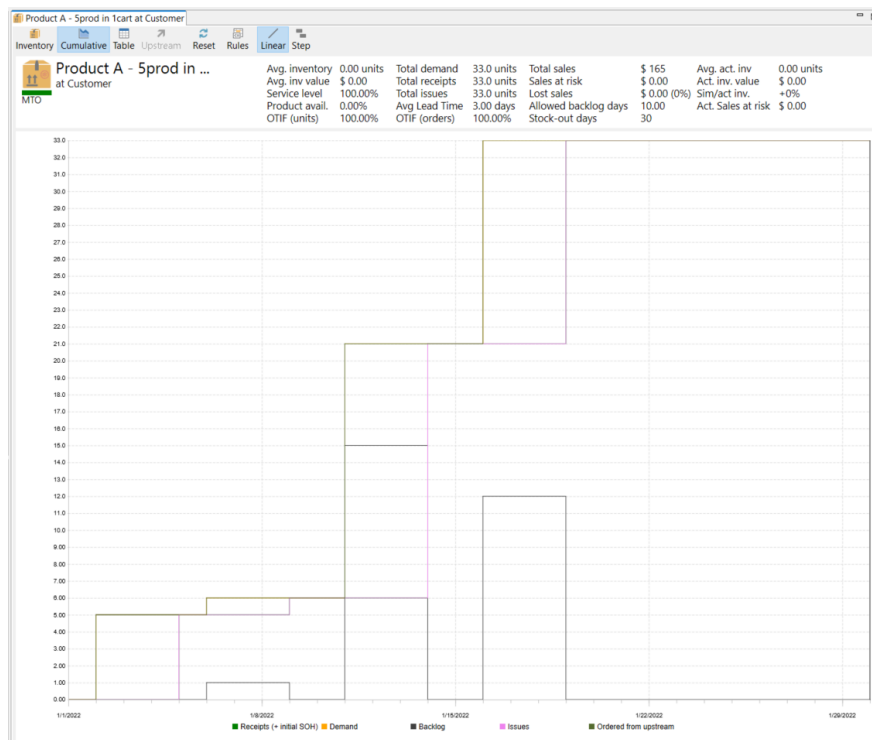


Figure 30: Cumulative Inventory Graph

The table view is shown in Figure 31 and each parameter is explained in the table below.

Act. Inv. Value

Product A - Sprod in 1cart at Customer

Inventory Cumulative **Table** Upstream Reset Rules Linear Step

Product A - 5prod in ...
at Customer
MTO

Avg. inventory	0.00 units	Total demand	33.0 units	Total sales	\$ 165	Avg. act. inv.	0.00 units
Avg. inv value	\$ 0.00	Total receipts	33.0 units	Sales at risk	\$ 0.00	Act. inv. value	\$ 0.00
Service level	100.00%	Total issues	33.0 units	Lost sales	\$ 0.00 (0%)	Sim/act inv.	+0%
Product avail.	0.00%	Avg Lead Time	3.00 days	Allowed backlog days	10.00	Act. Sales at risk	\$ 0.00
OTIF (units)	100.00%	OTIF (orders)	100.00%	Stock-out days	30		

Day #	Date	Stock on hand, units	Actual stock on hand, units	Stock on order, units	SOH + SOO, units	Demand, units	Forecast, units	Receipts, units	Issues, units	Backlog, units
0	1/1/2022	0	0	0	0	0	0	0	0	0
1	1/2/2022	0	0	5	5	5	5	0	0	5
2	1/3/2022	0	0	5	5	0	0	0	0	0
3	1/4/2022	0	0	5	5	0	0	0	0	0
4	1/5/2022	0	0	0	0	0	0	5	5	0
5	1/6/2022	0	0	1	1	1	1	0	0	1
6	1/7/2022	0	0	1	1	0	0	0	0	0
7	1/8/2022	0	0	1	1	0	0	0	0	0
8	1/9/2022	0	0	0	0	0	0	1	1	0
9	1/10/20...	0	0	0	0	0	0	0	0	0
10	1/11/20...	0	0	15	15	15	15	0	0	15
11	1/12/20...	0	0	15	15	0	0	0	0	0
12	1/13/20...	0	0	15	15	0	0	0	0	0
13	1/14/20...	0	0	0	0	0	0	15	15	0
14	1/15/20...	0	0	0	0	0	0	0	0	0
15	1/16/20...	0	0	12	12	12	12	0	0	12
16	1/17/20...	0	0	12	12	0	0	0	0	0
17	1/18/20...	0	0	12	12	0	0	0	0	0
18	1/19/20...	0	0	0	0	0	0	12	12	0
19	1/20/20...	0	0	0	0	0	0	0	0	0
20	1/21/20...	0	0	0	0	0	0	0	0	0
21	1/22/20...	0	0	0	0	0	0	0	0	0
22	1/23/20...	0	0	0	0	0	0	0	0	0
23	1/24/20...	0	0	0	0	0	0	0	0	0
24	1/25/20...	0	0	0	0	0	0	0	0	0
25	1/26/20...	0	0	0	0	0	0	0	0	0
26	1/27/20...	0	0	0	0	0	0	0	0	0
27	1/28/20...	0	0	0	0	0	0	0	0	0
28	1/29/20...	0	0	0	0	0	0	0	0	0
29	1/30/20...	0	0	0	0	0	0	0	0	0

Figure 31: Table View

Column heading	Description	Example
Day #	The day number. It starts at 0 at the start of the simulation.	0
Date	The date that correlates with the information given in the specified row.	2021/06/01
Stock on hand, units	The number of product units of the selected product in stock on the specified date.	13
Actual stock on hand, units	The actual stock on hand as per the input data (not simulated).	121
Stock on order, units	The number of units of the product that has been ordered but not received yet.	4

Column heading	Description	Example
SOH + SOO, units	The sum of the stock on hand and the stock on order.	17
Demand, units	The demand (in units) of the specified product at the specified location on the specified date.	450
Forecast, units	The forecasted demand (in units) for the specified product-location on the specified date.	300
Receipts, units	The units of the specified product received at the specified location on the specified date.	430
Issues, units	The units of the specified product issued at the specified location on the specified date.	430
Backlog, units	The number of units in backlog of the specified product at the specified location on the specified date.	20

When clicking on the rules button, the rule will pop up in a window right of the inventory graph, as shown in Figure 32.

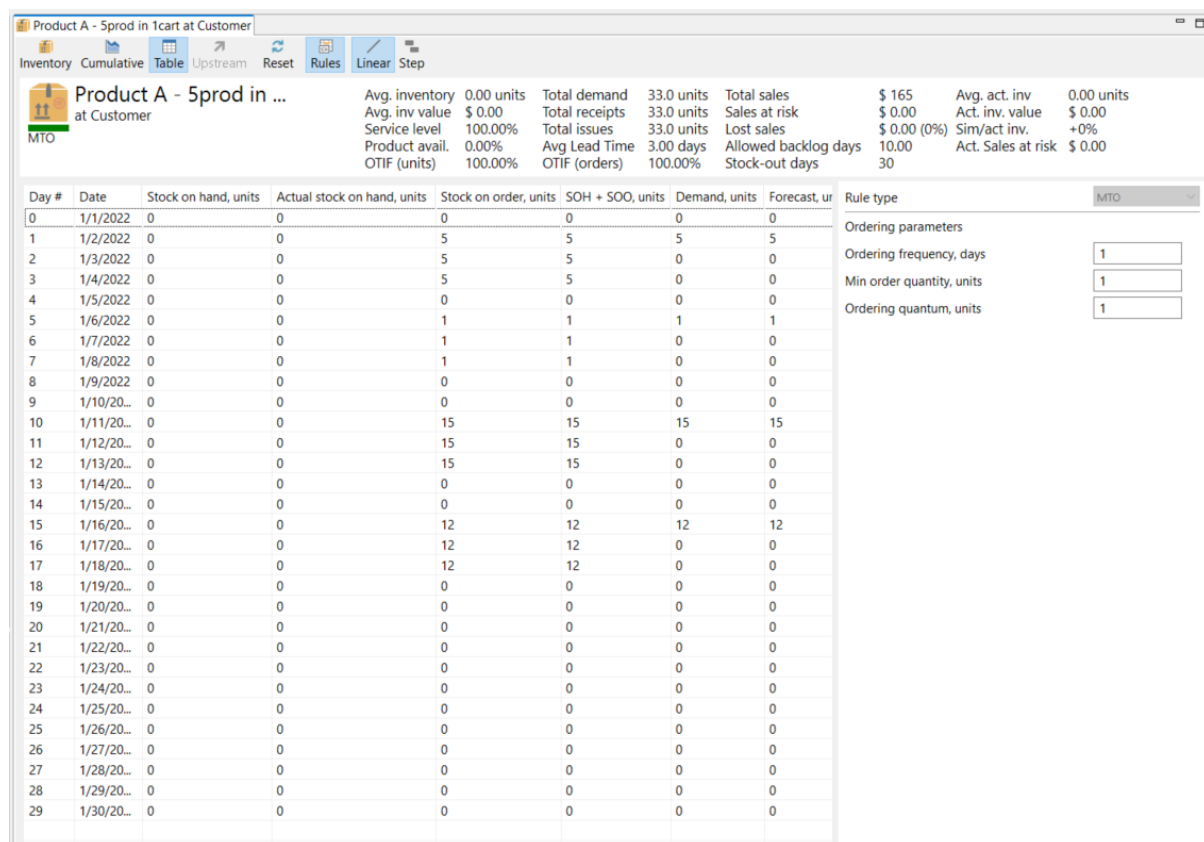
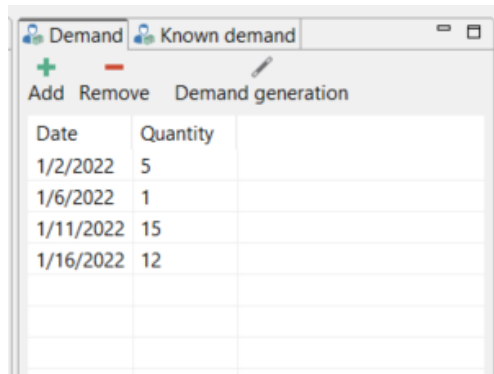


Figure 32: Inventory Rules

The Linear vs Step options change the lines on the inventory graph to either have a linear view or a step view.

4.5 Demand

The demand window shows the demand quantity (in units) that happens on a specific date. See Figure 33. Demand can also be generated using the Demand generation button.



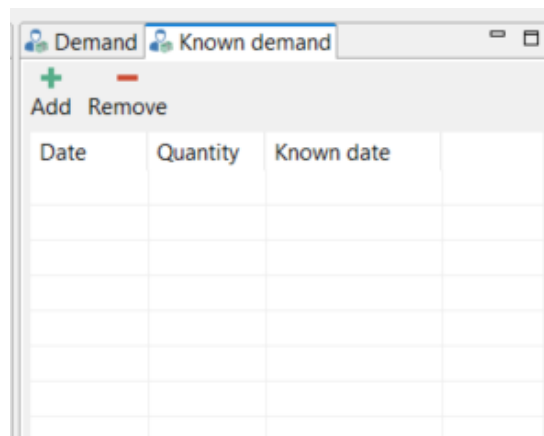
The screenshot shows a window titled 'Demand' with a sub-tab 'Known demand'. Below the title bar are buttons for '+', '-', 'Add', 'Remove', and 'Demand generation'. The main area contains a table with two columns: 'Date' and 'Quantity'.

Date	Quantity
1/2/2022	5
1/6/2022	1
1/11/2022	15
1/16/2022	12

Figure 33: Demand

4.6 Known Demand

The known demand window shows the demand quantity (in units) that is in the form of pre-orders per date. It also indicates the date on which the pre-order was made in the Known date column. See Figure 34.



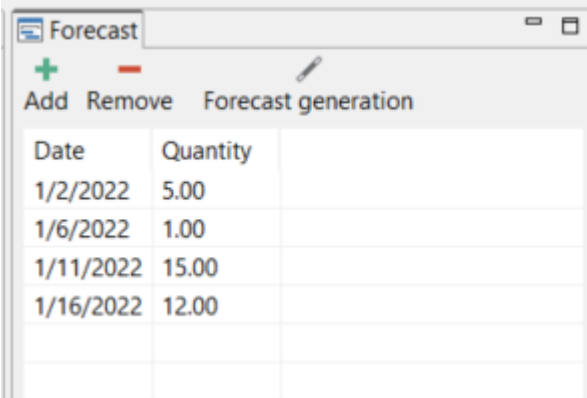
The screenshot shows a window titled 'Demand' with a sub-tab 'Known demand'. Below the title bar are buttons for '+', '-', 'Add', and 'Remove'. The main area contains a table with three columns: 'Date', 'Quantity', and 'Known date'.

Date	Quantity	Known date

Figure 34: Known Demand

4.7 Forecast

The forecast window shows the forecasted demand (in units) for a specific date. A new forecast can be generated using the Forecast generation button. See Figure 35.

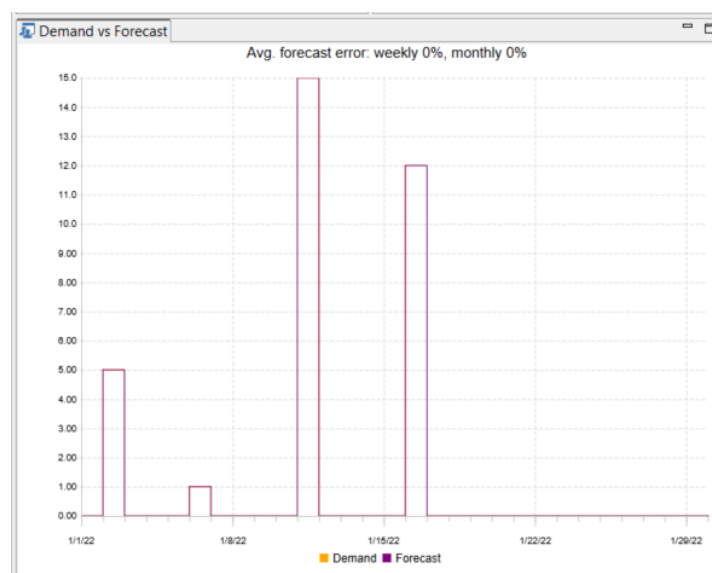


Date	Quantity
1/2/2022	5.00
1/6/2022	1.00
1/11/2022	15.00
1/16/2022	12.00

Figure 35: Demand Forecast

4.8 Demand vs Forecast

The demand vs forecast graph shows the demand and the forecast quantities on the y-axis, and the simulation period on the x-axis. The average forecast error per week and per month can be seen at the top of the graph as a percentage. See Figure 36.

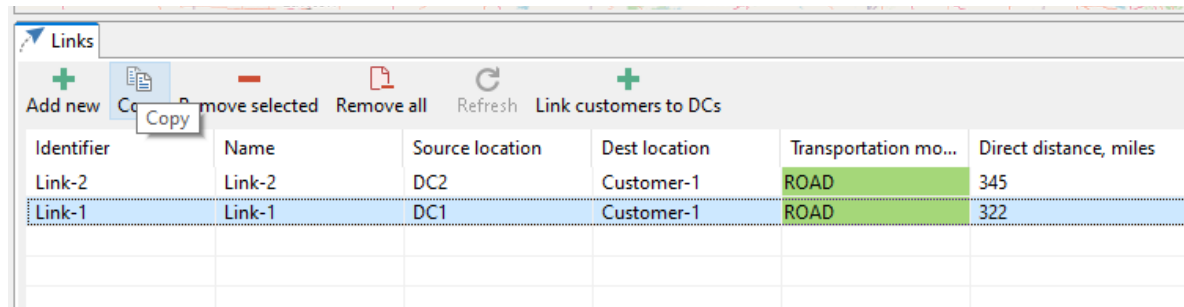
*Figure 36: Demand vs. Forecast*

5 Additional Features

5.1 Editing mode

5.1.1 Copy Function

A line in the user interface can easily be copied. Click on the line you want to duplicate, and then click the copy icon as indicated below.



Identifier	Name	Source location	Dest location	Transportation mo...	Direct distance, miles
Link-2	Link-2	DC2	Customer-1	ROAD	345
Link-1	Link-1	DC1	Customer-1	ROAD	322

Figure 37: Copy Row in User Interface

5.2 Screens

5.2.1 Moving Windows

The windows on the screen can be minimized, maximized, or moved, depending on what you want to see. Refer to Figure 38. When you click on 1 in Figure 38, the window will be minimized, and a sidebar will appear as shown in Figure 39. When you click on the icon at the top of the sidebar as indicated in Figure 39, the window will show again. When you click on 2 in Figure 38, the window will open in full screen as shown in Figure 40. It can then be minimized by clicking on the icon as per Figure 40.

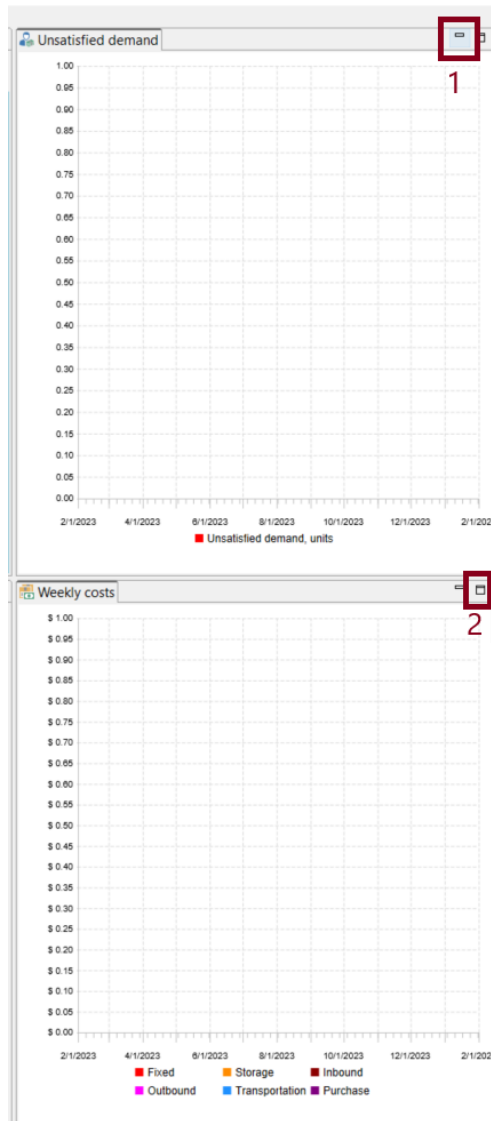


Figure 38: Minimize and maximize screens in the output

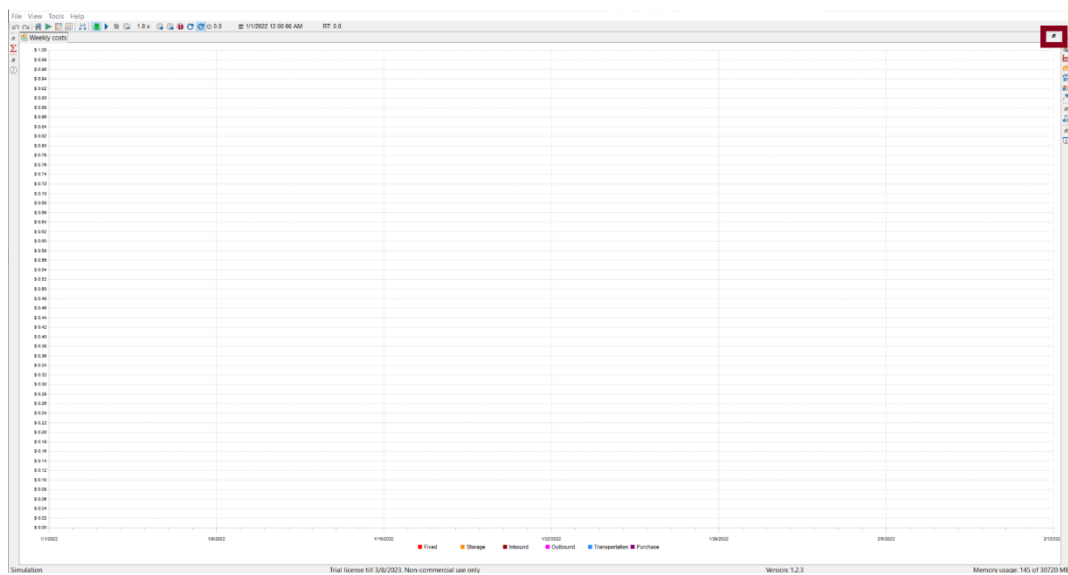


Figure 39: Maximize screen in the output

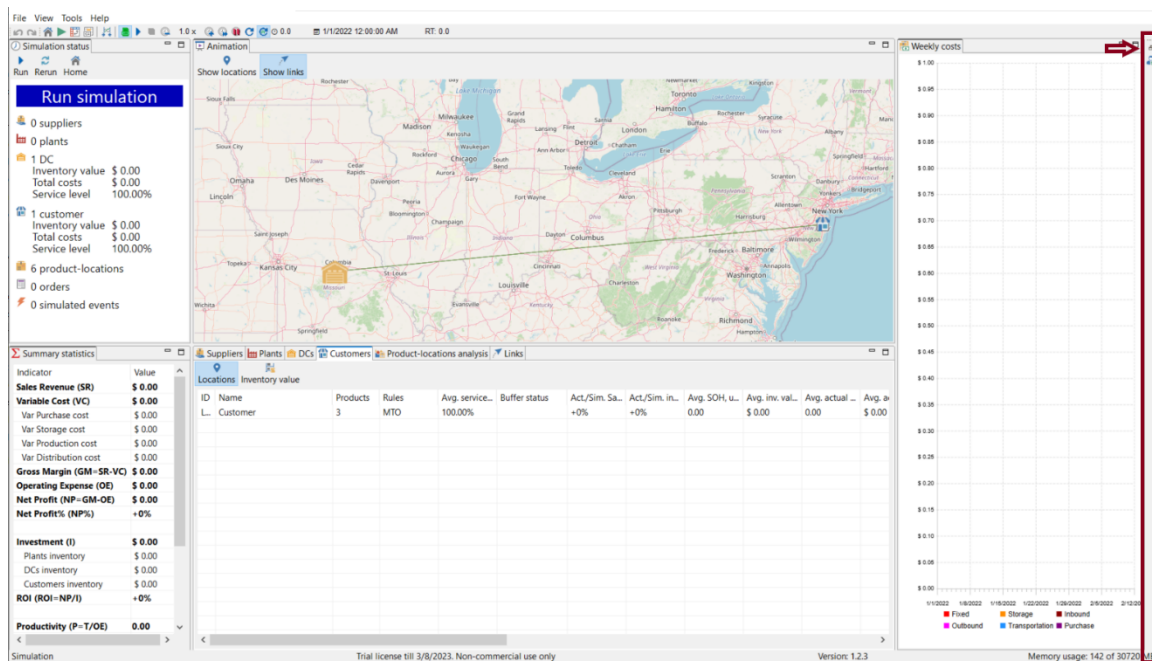


Figure 40: Full screen in output

5.3 Editing and Output mode

5.3.1 Filters

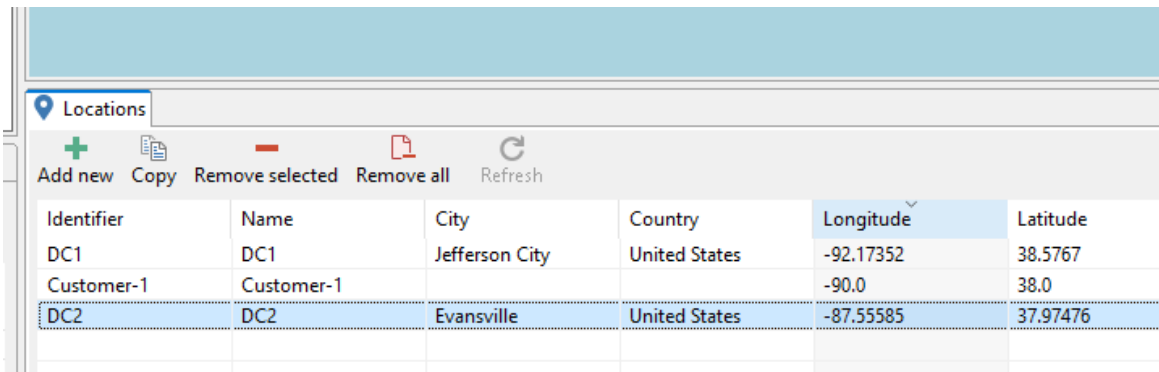
Use filters in any column in the User interface. Right-click on the criteria you want to use in the column you want to filter.

Identifier	Name	Country	Longitude	Latitude	Monthly fixed
DC1	DC1	United States	-92.17352	38.5767	0.0
Customer-1	Customer-1		-90.0	38.0	0.0
DC2	DC2	United States	-87.55585	37.97476	0.0

Figure 41: Filter in the User Interface

5.3.2 Sorting of Tables

Sort a table from small to large or alphabetically by clicking on the column headings. A small arrow will appear. Below in Figure 42, the longitude column is sorted in descending order.



Identifier	Name	City	Country	Longitude	Latitude
DC1	DC1	Jefferson City	United States	-92.17352	38.5767
Customer-1	Customer-1			-90.0	38.0
DC2	DC2	Evansville	United States	-87.55585	37.97476

Figure 42: Table sorting in the User Interface

5.4 How to adjust the allowed memory of the application

This section shows how to increase the allowed memory/RAM on Windows and Mac computers. This is especially important when running the model on a server.

5.4.1 Windows

Edit the Scholastic.ini file using a standard text editor by increasing the -Xmx parameter as shown in Figure 43. Please note: G = Gigabyte.

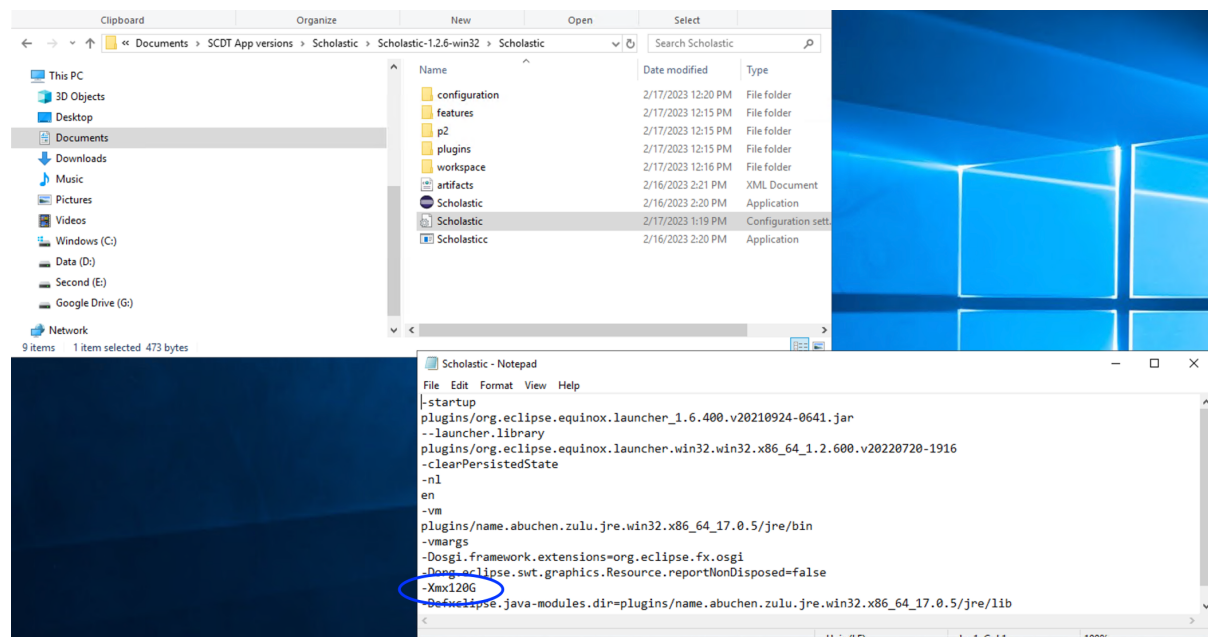


Figure 43: Windows Adjust Memory

5.4.2 Mac

Edit the Scholastic.ini file using a standard text editor by increasing the -Xmx parameter as shown in Figure 44 and Figure 45. Please note: G = Gigabyte.

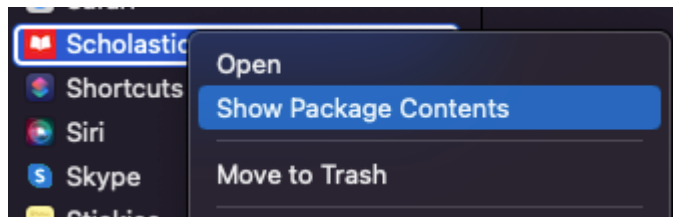


Figure 44: Mac Show Contents

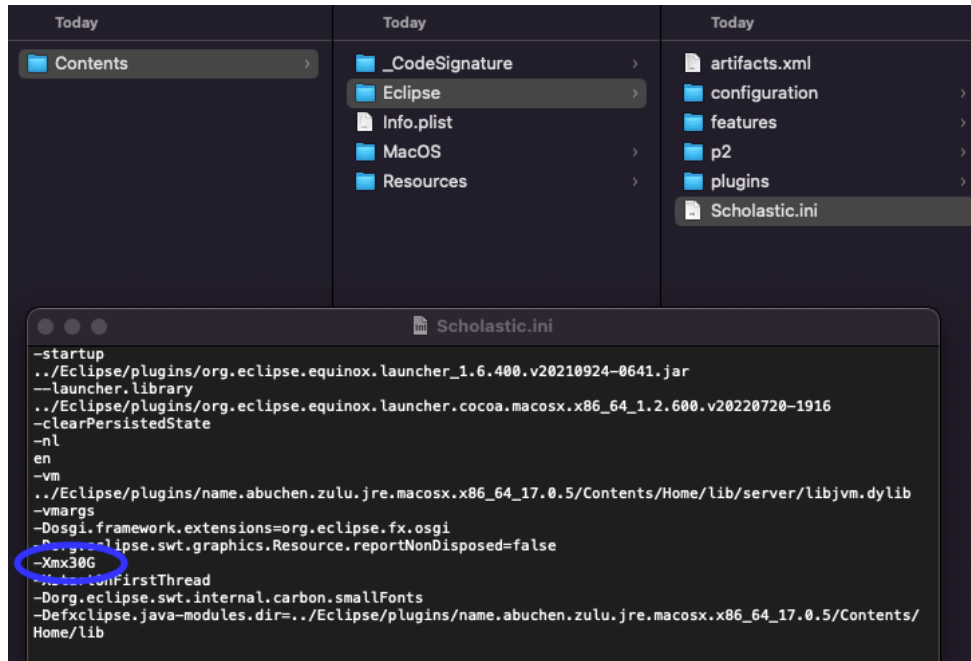


Figure 45: Mac Adjust Memory

6 Troubleshooting

If any errors occur during model execution, please report the error to support@goldrattresearchlabs.com as soon as possible. The model contains many checks and balances to ensure that data inputs are accurate and that the integrity of the data is preserved. The model execution is also checked and unexpected behavior will be flagged. Errors can occur if there is a problem that was not picked up during the scenario loading and initialization phase of the model execution. Errors can also be caused by bugs in the model logic. If an error occurs, copy the relevant error message into a text editor and review the text to identify the problem. It may be possible to correct the error based on the content of the error message. If you experience any errors that you cannot easily resolve, please contact us for assistance. Follow the steps described in section 7.1.

6.1 Error reporting

To report an error to support@goldrattresearchlabs.com, please send the following:

- The scenario file that was used.
- A copy of the error message (it can be pasted into a plain text file, a Word document, or directly in the email).
- If the error occurred during the model execution then please include any settings that were changed for the scenario.

If possible, include screenshots and/or a screen recording of the steps taken that resulted in a model error.

7 Appendixes

7.1 Random Generator

Each distribution uses the single source of randomness, the RandomGenerator object that lives inside the Model class. This RandomGenerator object is shared among all Distribution objects. So, all Distribution objects transitively use the same seed.

The aftermath of this shared usage of the RandomGenerator is as follows: after we added two new fields of Distribution type to the LinkCapacityRecord, those new fields may 'steal' some random numbers from the RandomGenerator that otherwise would go to the Link's lead time Distribution-typed field sample.

Example:

Imagine that the RandomGenerator creates some random values in the range [0..99], and produces the following sequence (each time the sequence is the same, because the seed is the same): 1, 45, 2, 3, 67, 98, ...

In the v. 1.39.0, only link's lead time is random. In the scenario we run there is one link with a triangularly distributed lead time that samples its lead time and somehow (but strictly deterministically) converts the numbers produced by the RandomGenerator into an appropriate numbers according to the desired distribution type (this conversion is deterministic):

3.4 (produced from RandomGenerator value 1); 4.5 (from 45); 1.5 (from 2); 2.5 (from 3); 4.2(from 67); 4.4 (from 98); ...

Now we switch the v. 1.40.0. Here, one LinkCapacityRecord is added that has two more Distribution-typed fields, each of which uses exactly the same RandomGenerator.

During the model execution, the two new LinkCapacityRecord fields get sampled. When this happens, they just ask the RandomGeneragor for the next random values and deterministically convert it to something appropriate based on the desired distribution types. E.g., if this sampling (two samplings, to be correct, since there are two new fields and they both get sampled simultaneously) happens before the link samples its lead time, then the first lead time we'll observe for the link will be based on some other value from the (unchanged) random sequence produced by the RandomGenerator:

1.5 (from 2); 2.5 (from 3); 4.2(from 67); 4.4 (from 98);...

So, now lead times sequence starts with 1.5, not with 3.4, because two initial values produced by the RandomGenerator (1 and 45) were 'stolen' when sampling the two new fields in the single instance of LinkCapacityRecord.



**Contact us with questions, bug reports, or
any other improvement suggestions.**

Prepared for

Supply Chain digital Twin

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