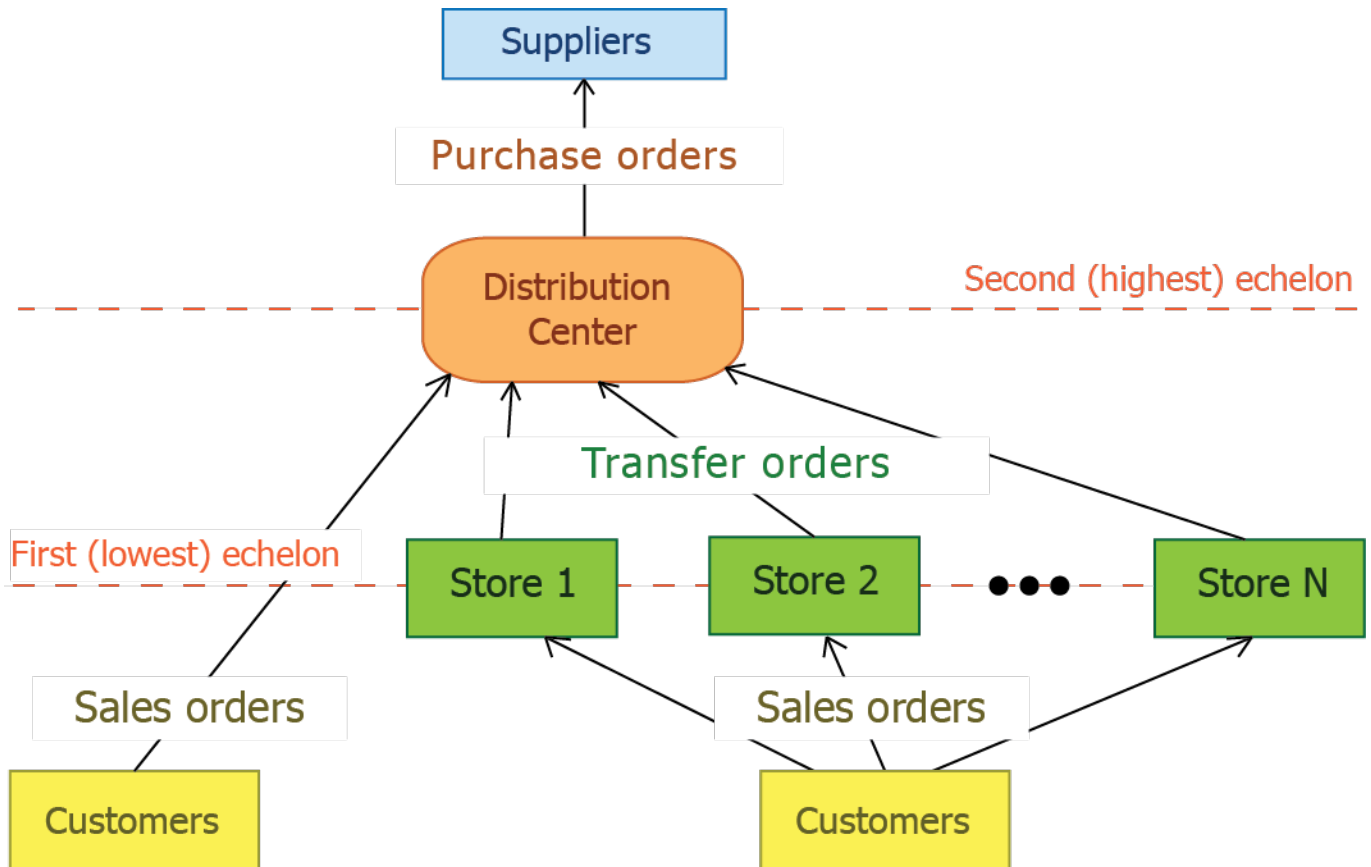


6.4.2. Two-Echelon Planning

In this article, we explain how Streamline calculates a DC ordering plan for planning items that are distributed in this DC. These items are shown on the **Distribution center** tab.

Consider an example of a two-echelon model represented in the figure below.



In the example, an item is distributed over N stores from a distribution center. In addition to the distribution, DC sells this item to customers.

To calculate a DC ordering plan for such an item, Streamline performs two steps:

1. First, it **calculates** ordering plans for this item for N locations at the lowest echelon based on the sales forecasts. This gives us N *Ordering plans* which form a part of DC demand at the highest echelon.

2. Then, the DC ordering plan is calculated using the Excel-like formulas below.

$$DC\ order\ qty_1 = \text{MAX}(\text{CEILING}(\text{MAX}(0, D_{sales_{oc}} + D_{oc} + \text{DC safety stock} + Qty_{to_ship_{LT,OC}} - \text{Remaining} + \text{Debt}_{accumulated}), \text{DC rounding}), \text{DC min lot}), (1)$$

$$\text{Remaining} = \text{MAX}(0, \text{MAX}(0, \text{DC on hand}) + Qty_{to_receive_{LT,OC}} - (D_{sales_{LT}} + D_{LT})),$$

$$D_{OC} = \sum_{j=1}^N \int_{LT}^{LT+OC} \text{Ordering plan } j$$

$$D_{LT} = \sum_{j=1}^N \int_0^{LT} \text{Ordering plan } j$$

Where:

- $D_{sales_{OC}}$ - the demand forecast generated based on the item sales in the DC during the **DC order cycle** coming after the **DC lead time**. If the DC doesn't sell the item, this term equals zero.
- $D_{sales_{LT}}$ - the demand forecast generated based on the item sales in the DC during the **DC lead time**. If the DC doesn't sell the item, this term equals zero.
- D_{OC} - the demand forecast generated based on the item distribution demand from N locations at the lowest echelon during the **DC order cycle** coming after the **DC lead time**.
- D_{LT} - the demand forecast generated based on the item distribution demand from N locations at the lowest echelon during the **DC lead time**.
- *Ordering plan* $_j$, $j = 1, \dots, N$ - the ordering plans calculated for the item at the lowest echelon (see [Step 1](#)). These are shown in the [Ordering plan](#) section on the **Inventory planning** tab.
- $Qty_to_ship_{LT,OC}$ and $Qty_to_receive_{LT,OC}$ - the quantities that are to be shipped and received to the DC correspondingly within the **DC lead time** plus **DC order cycle** period. Those can be viewed in the [In transition details dialog](#) opened from the **Distribution center** tab.
- *Debt accumulated* - the [accumulated safety stock debt](#) that should be ordered to restock safety stocks for N locations at the lowest echelon. It is [calculated](#) at the highest echelon.
- **DC safety stock** - the safety stock for the item in DC. In our case, it is a sum of two safety stocks. [One of them](#) refers to sales activity, [another one](#), to distribution. It is shown in the **DC safety stock** column on the **Distribution center** tab.
- **DC on hand, DC order cycle, DC lead time, DC rounding, DC min lot** - replenishment parameters shown in the [Distribution center tab](#).

The calculated *DC order qty* $_1$ is shown in the [Qty](#) column of the **Current order** section on the **Distribution center** tab.

Formula (1) determines the quantity to order for the first DC order cycle. To calculate replenishment quantities for next order cycles, the following Excel-like formula is used:

$$DC\ order\ qty_1 = \text{MAX}(\text{CEILING}(\text{MAX}(0, D_{sales}(OC_i) + D(OC_i) + DC\ safety\ stock_i + Qty_to_ship(OC_i) - Qty_to_receive(OC_i) - Remaining_i), \text{DC rounding}), \text{DC min lot}), (2)$$

$$D(OC_i) = \sum_{j=1}^N \int_{OC_{i-1}}^{OC_i} \text{Ordering plan } j$$

Where:

- $D_{sales}(OC_i)$ - the demand forecast generated based on the item sales in the DC during **i-th DC order cycle**. If the DC doesn't sell the item, this term equals zero.
- D_{oc} - the demand forecast generated based on the item distribution demand from N locations at the lowest echelon during **i-th DC order cycle**.
- $Ordering\ plan_j$, $j = 1, \dots, N$ - the ordering plans calculated for the item at the lowest echelon (see [Step 1](#)).
- $Qty_to_ship(OC_i)$ and $Qty_to_receive(OC_i)$ - the quantities that are to be shipped and received to the DC correspondingly within **i-th DC order cycle**.
- $DC\ safety\ stock_i$ - the DC safety stock for **i-th DC order cycle**.
- $Remaining_{i-1}$ - the remaining DC on-hand at the end of the previous **DC order cycle** period.
- **DC order cycle, DC rounding, DC min lot** - replenishment parameters shown in the [Distribution center tab](#).

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