E-Marketplace Model Integrated with Logistics

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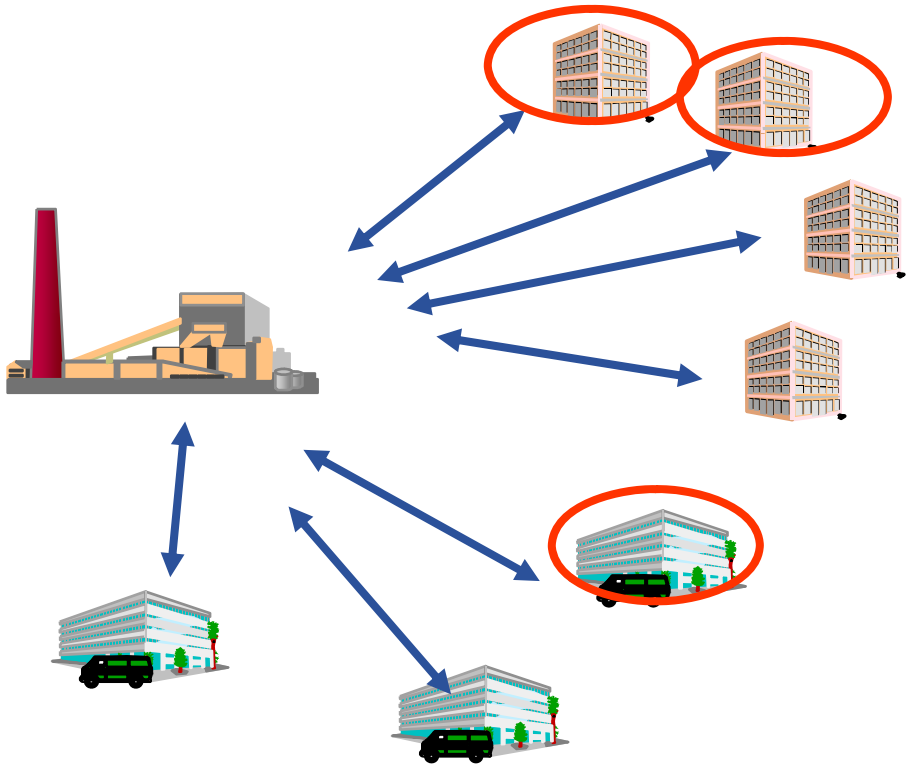
The goal

- To buy several products from suppliers
- To find logistic service providers who can deliver the goods
- To **minimize overall price**: price of goods + price of delivery



Parameters for the optimization

- **Number of different products**
- **Quantity of each product**
- **Number of suppliers**
- **Container size**
- **Price bids from suppliers:**
  - Product price
  - Delivery fix cost
  - Delivery variable cost

Mathematical model

$$\min \left(\begin{array}{l} \sum_{k=1}^{M} \left(\sum_{i=1}^{N} P_i^k Q_i^k \right) \left(1 - \Delta^k\right) + \\ \sum_{l=1}^{L} \sum_{j \in S^l} x_j^l \left(F_j^l \left\lceil \left(\sum_{k \in \Gamma_j^l} \sum_{i=1}^{N} Q_i^k \right) / Z \right\rceil + V_j^l \sum_{k \in \Gamma_j^l} \sum_{i=1}^{N} Q_i^k \right) \end{array} \right)$$

Q_i^k Purchased quantity of product i. from seller k.

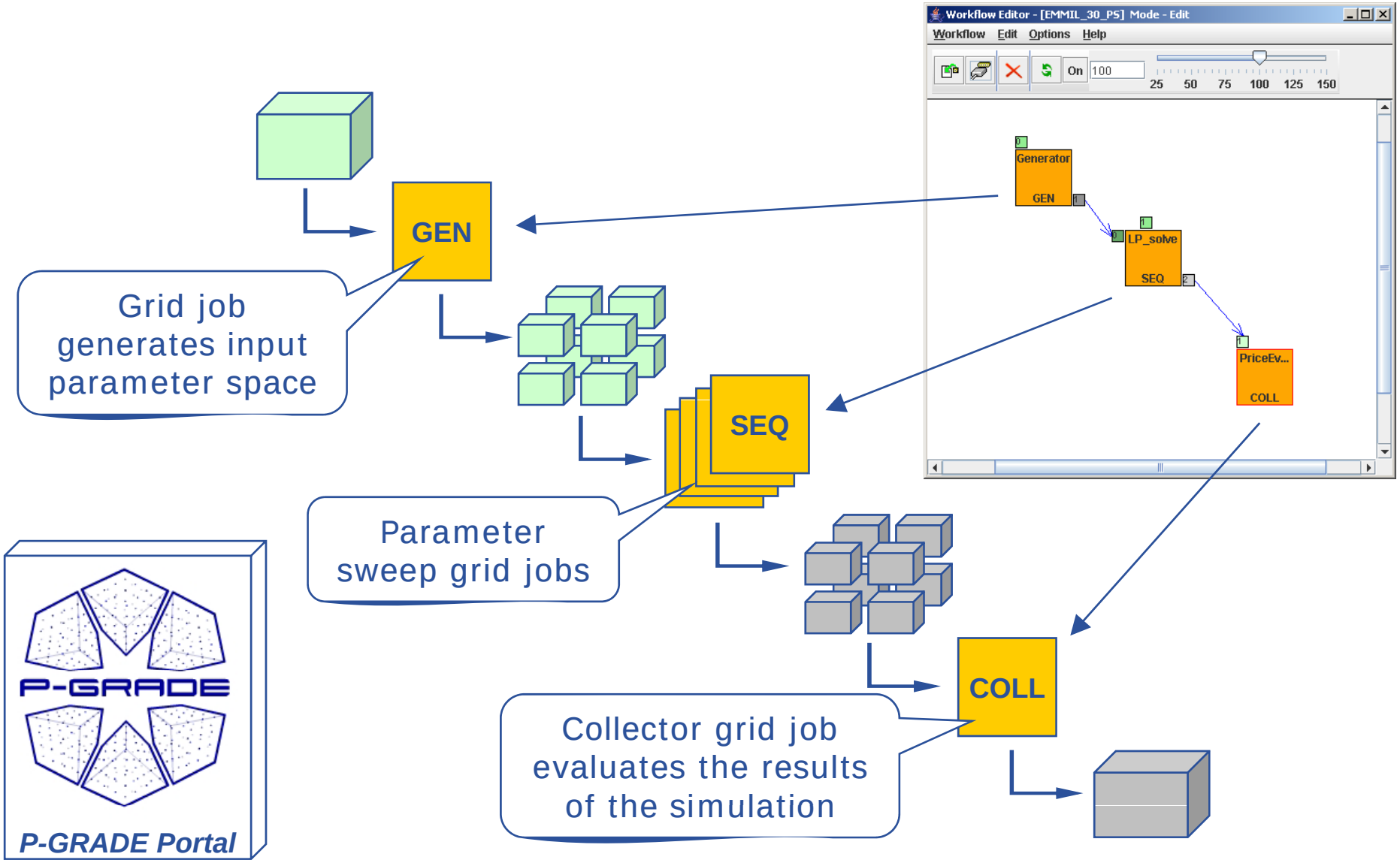
P_i^k Unit-price of product i. at seller k. as a step function of quantity

Δ^k Discount given as a step function after the total purchase cost at seller k.

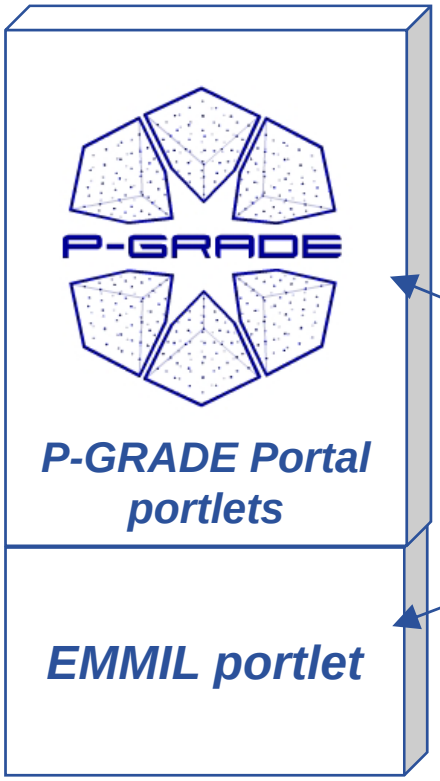
$x_j^l \in \{0,1\}$ decision variable

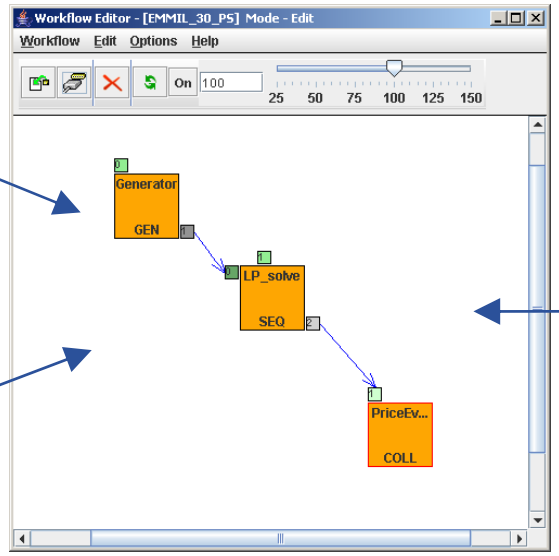
$x_j^l = 1$ $\Leftrightarrow$ offer j. of 3PL l. is selected as winner

Parameter Study Workflow



EMMIL on SEE-GRID/GILDA



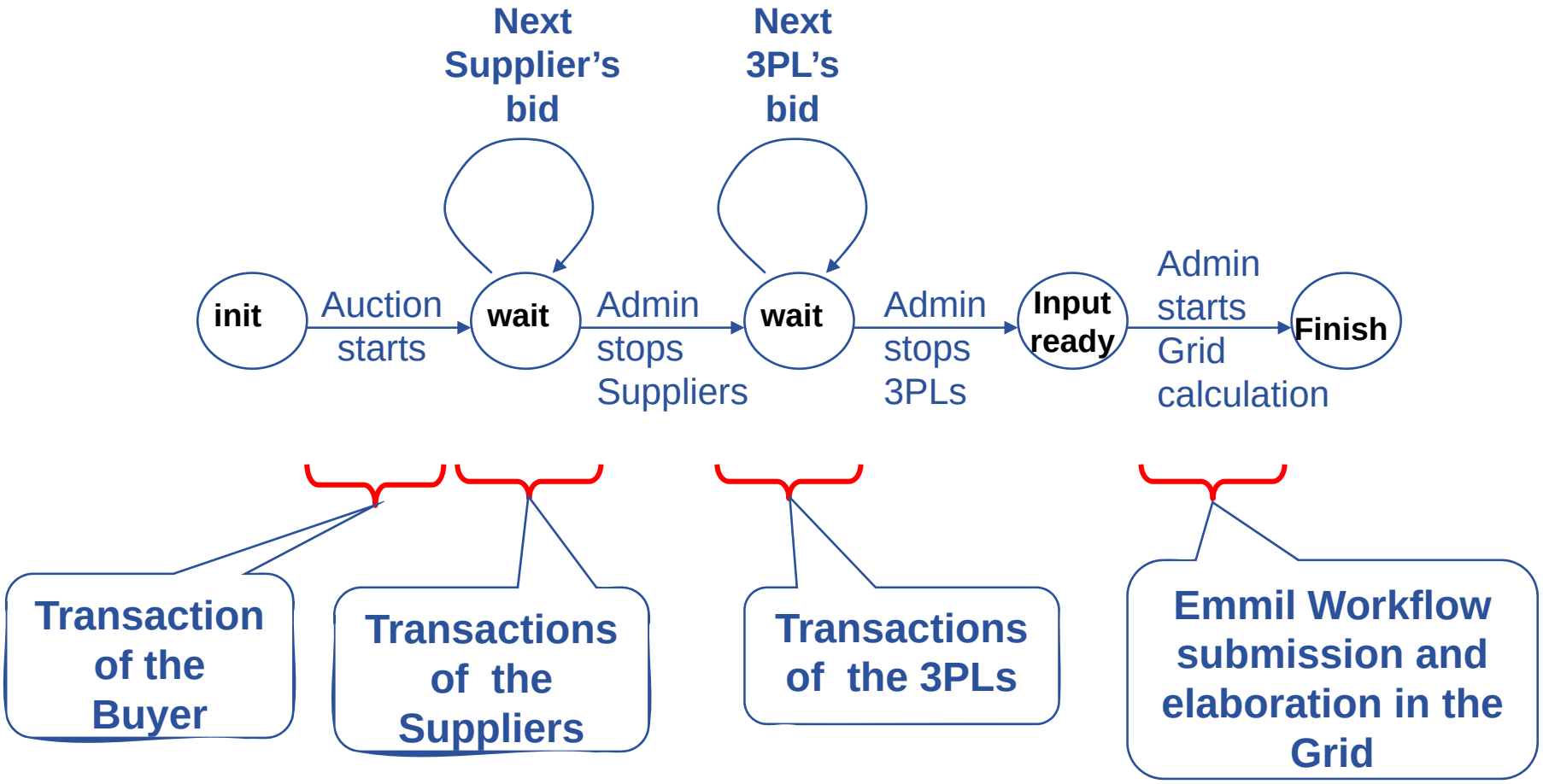


User interface

Parameter study workflow

gLite based grid infrastructures

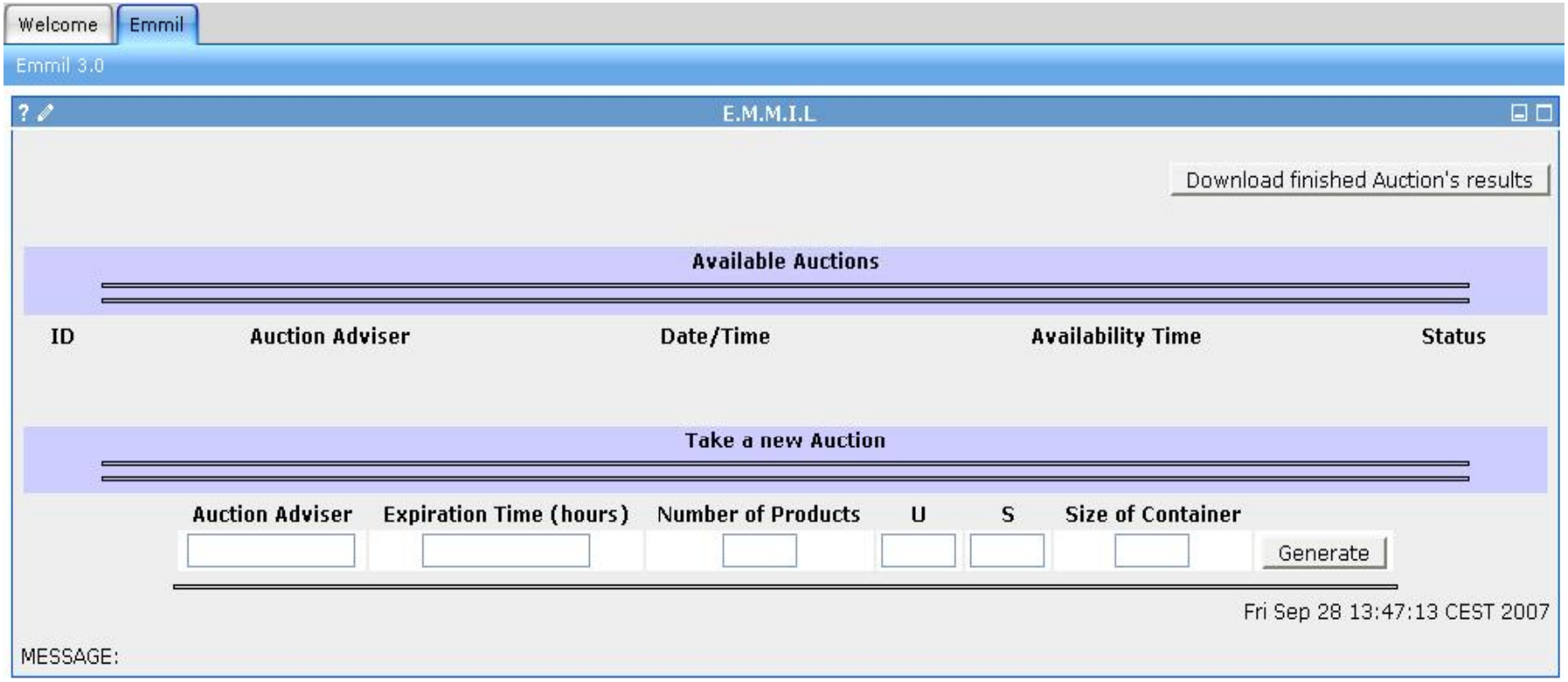
Auction: Main states of business process



Remark: **Buyer**,**Suppliers**,**3PLs** and **Admin** cast as different users of the P-Grade Portal

Transaction of the Buyer(1/2)

- First, a Buyer has to open an Auction by typing his/her name, time of bid expiration, number of requested products, how many supplier offer should be prefiltered(U), the max number of the winner Suppliers and the size of standard Container.



Transaction of the Buyer(2/2)

- **In the second page of the transaction the buyer has to define the needed commodities (Product's name, and the quantities).**

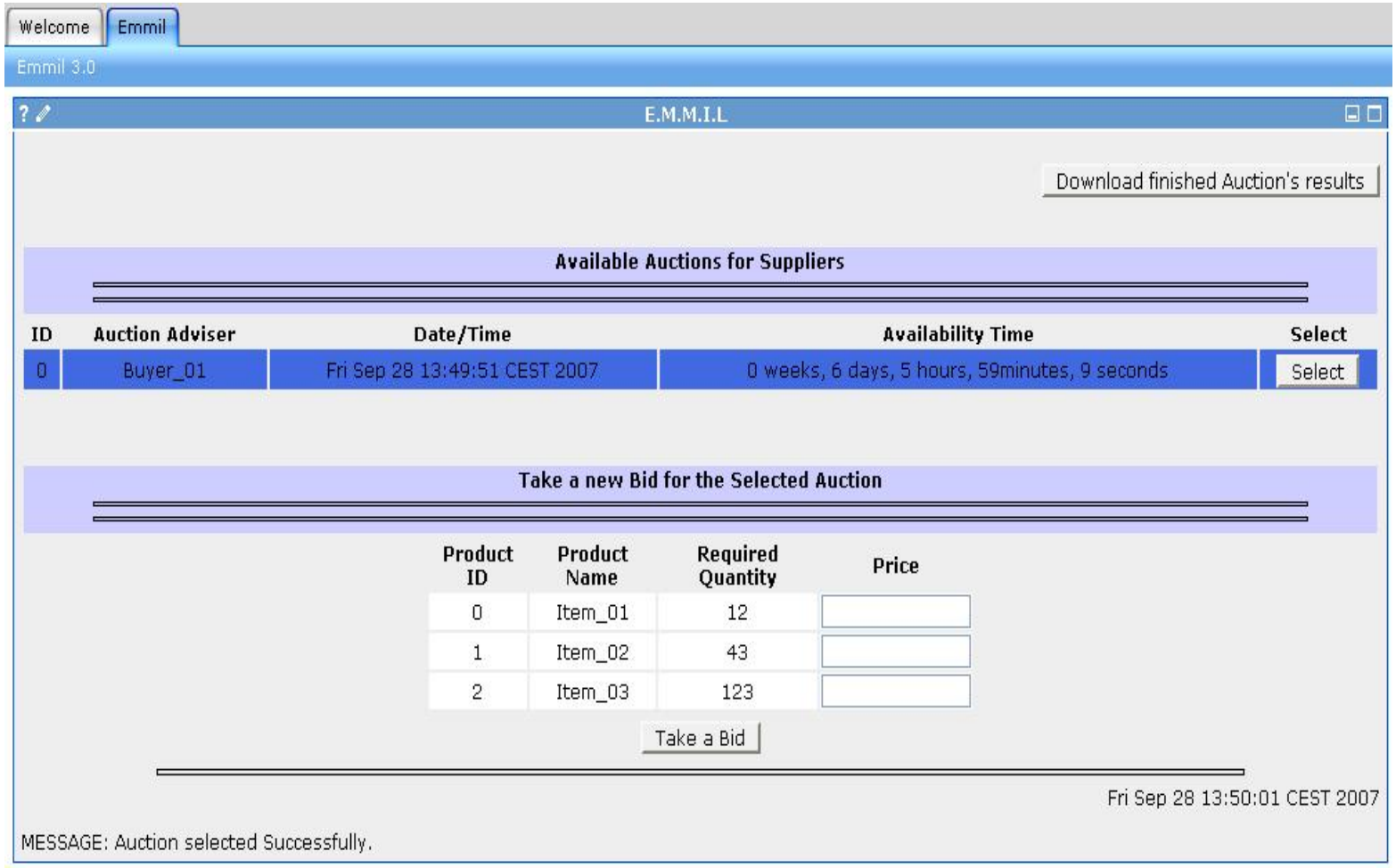
(In this case Buyer need only 3 Products.)

Transactions of the Suppliers(1/2)

- A competing supplier logs into the portal to investigate opened auctions. By selecting one auction the supplier can make an offer

Transaction of the Suppliers(2/2)

- **Price must be defined to each item to take a bid**



Admin closes the period of accepting Supplier's bids

- **Administrator can close the auction for the Suppliers prematurely.(Option to define "M" serves simulation purposes)**

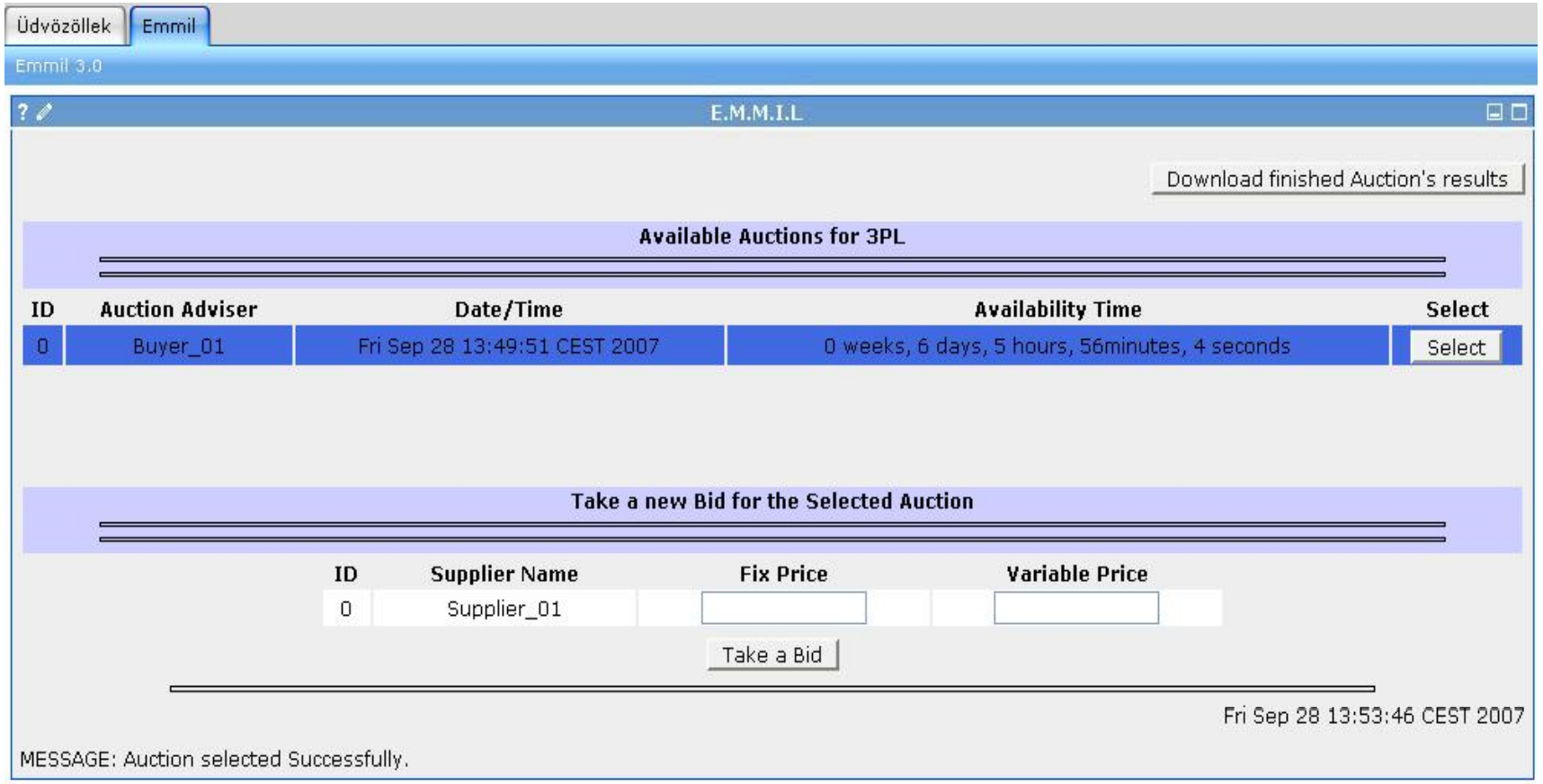
- **That means, the auction for 3PL is opened.**

Transactions of the 3PLs(1/2)

- **A competing 3PL logs in to the portal to investigate opened auctions. By selecting one the 3PL can make an offer.**

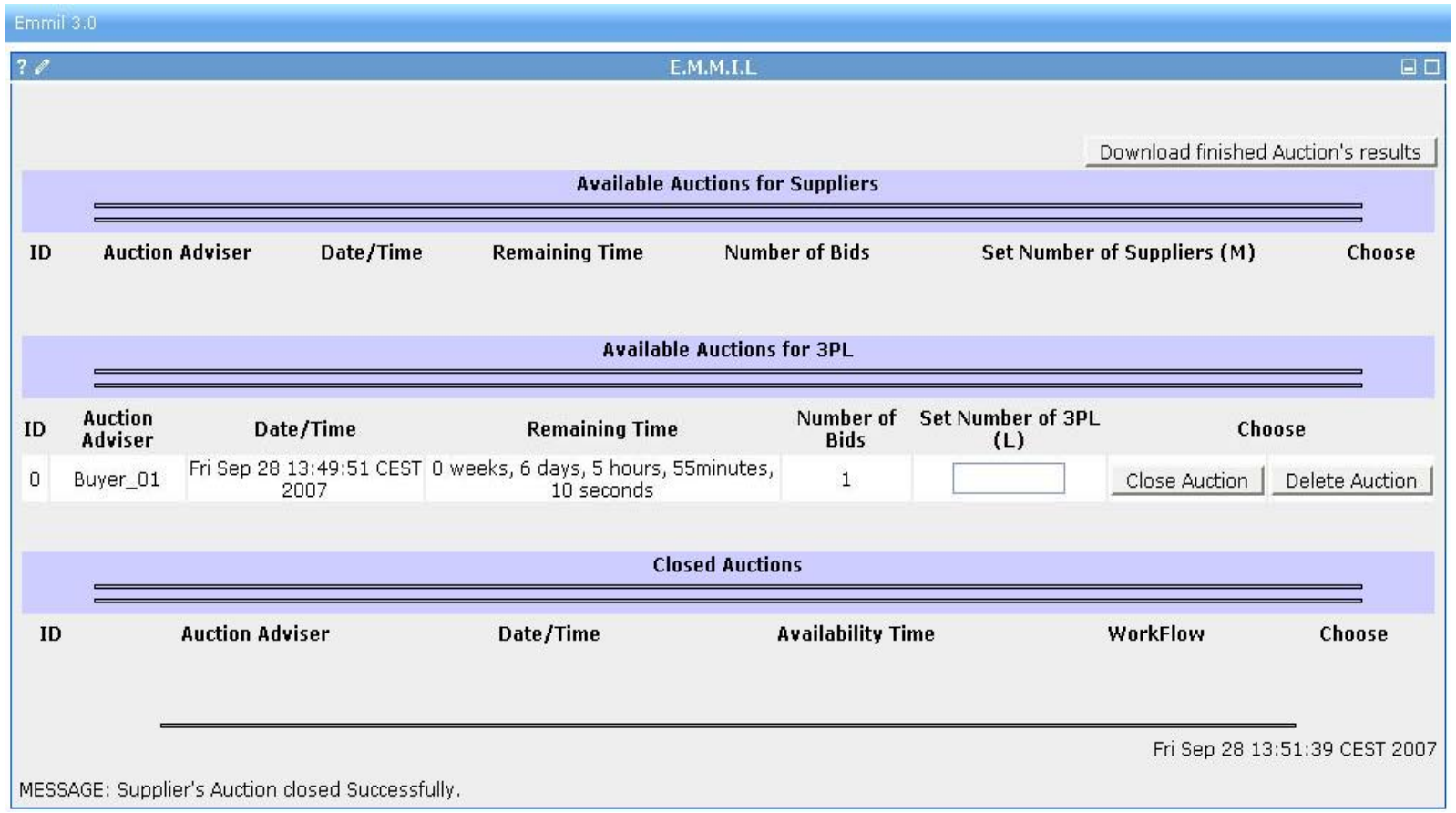
Transactions of the 3PLs(2/2)

- **The 3PL associates a fix and a variable cost to each supplier listed in the list. (Note that in this list there is just one supplier)**



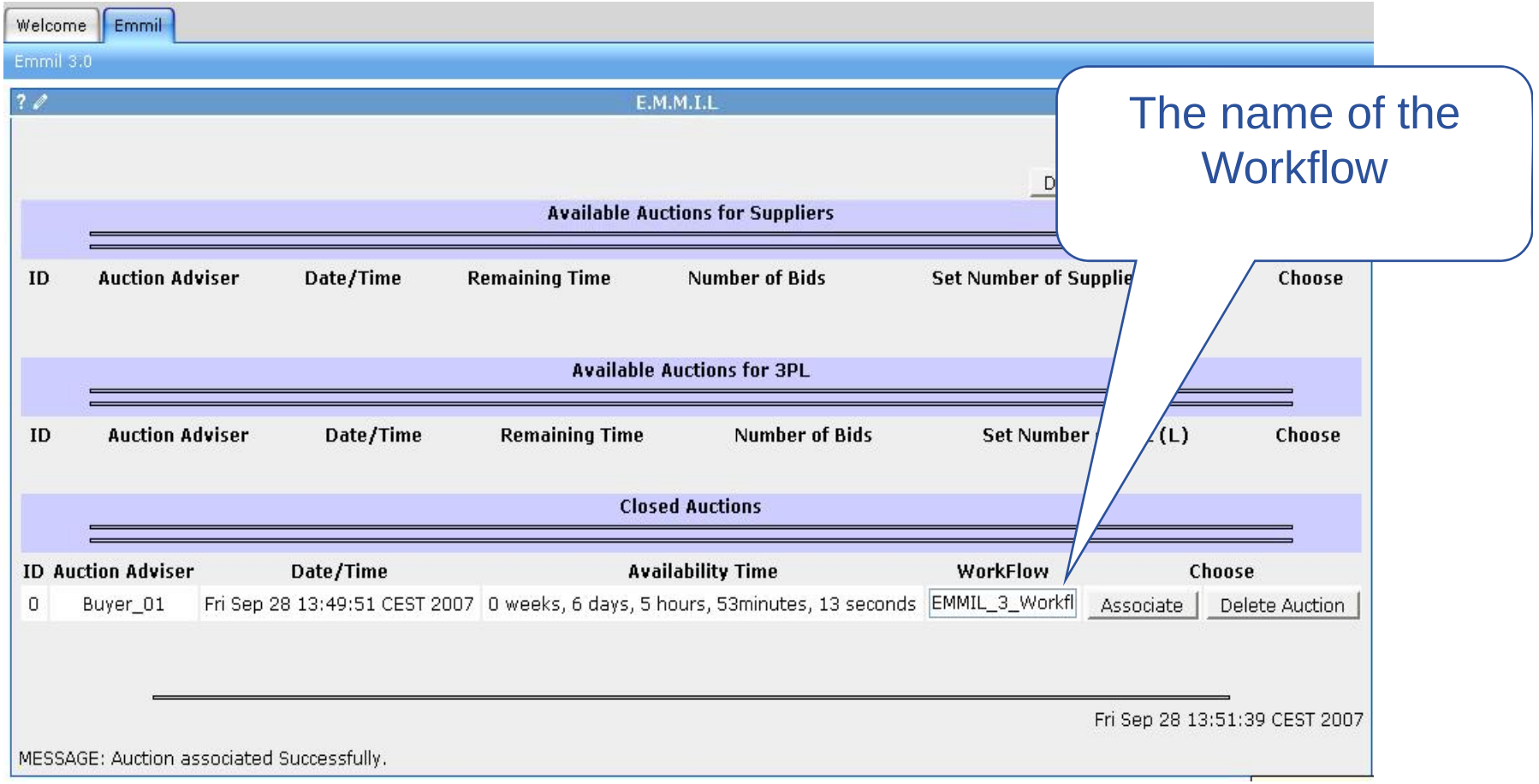
Admin closes the period of accepting 3PL's bids

The Administrator can close the auction for the 3PLs prematurely.(Option to define "L" serves simulation purposes)



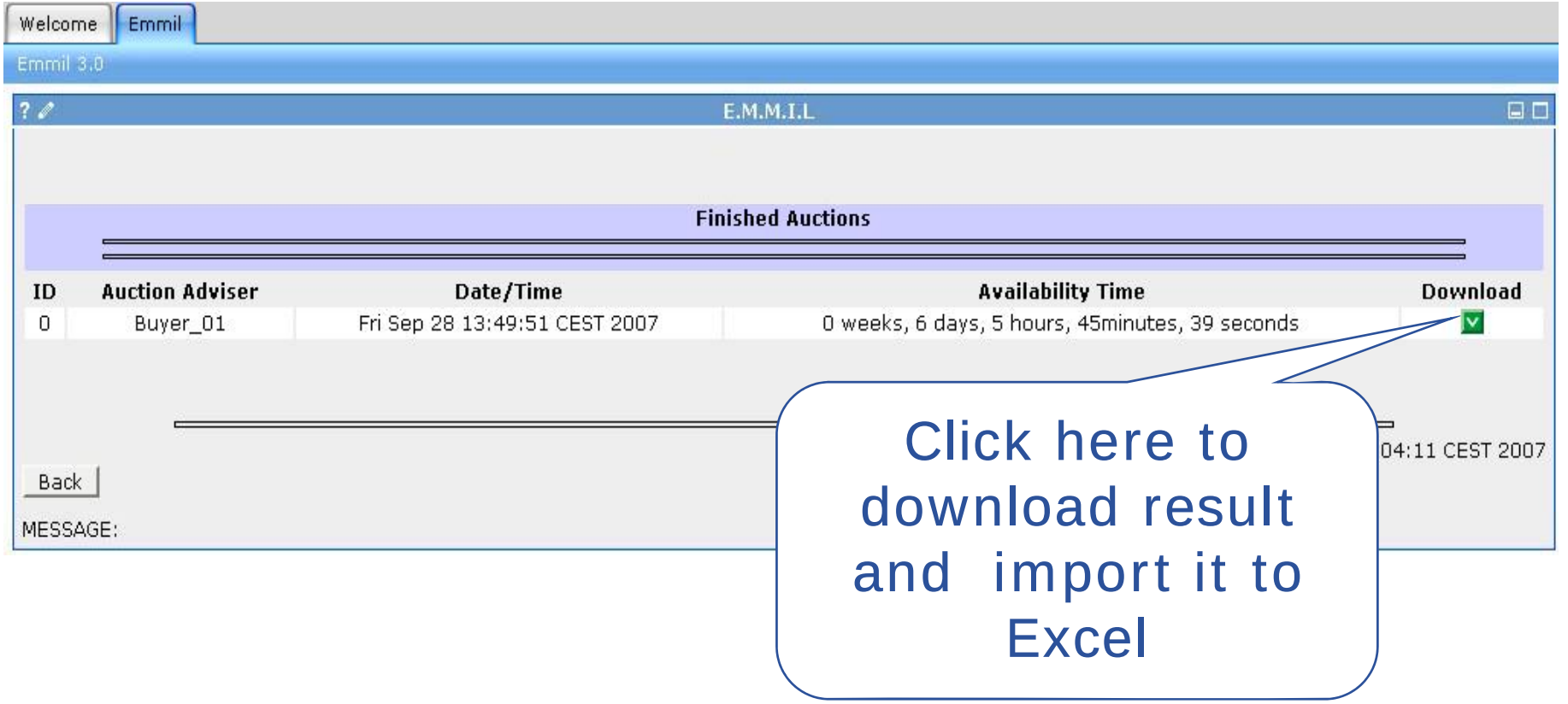
Admin starts Grid calculation

- **Associating to a Workflow. (The optimization begins now)**

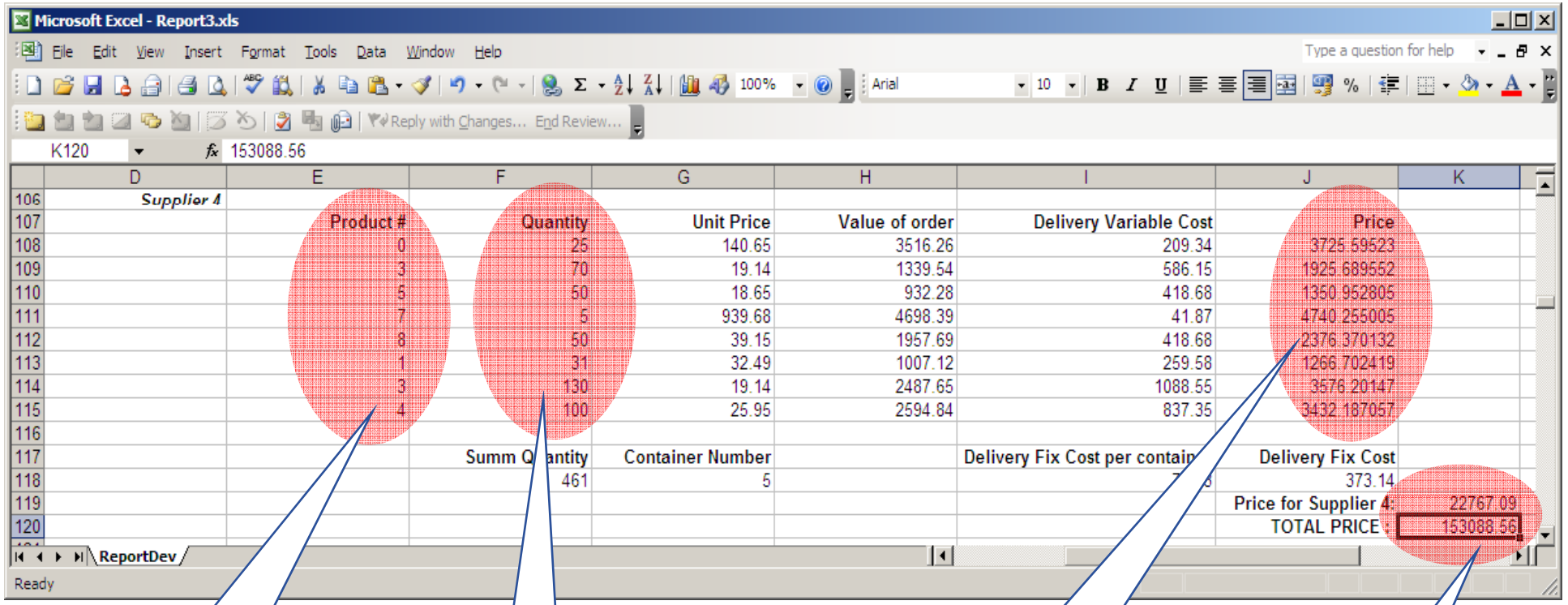


When workflow has finished…

- **Any user can download the results of the Auction.**



Result of grid execution: Downloadable Excel sheet



Product type

Quantity to order

Price per product

Total price