

E-Marketplace Model Integrated with Logistics



MTA SZTAKI
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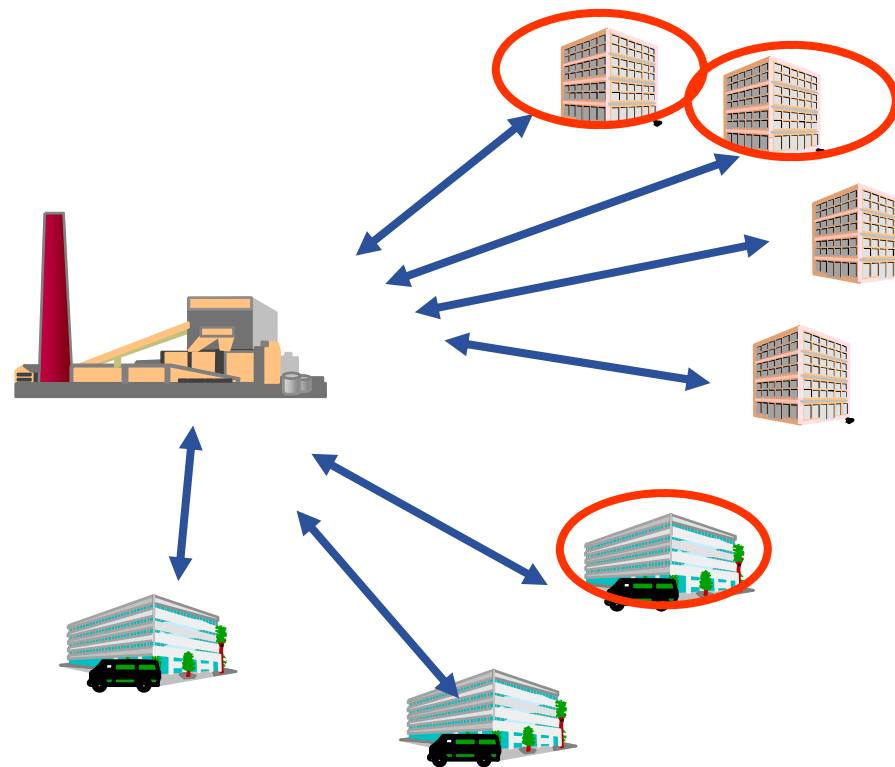
International Business School
Budapest



Worcester Polytechnic Institute
USA



- 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



- 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



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

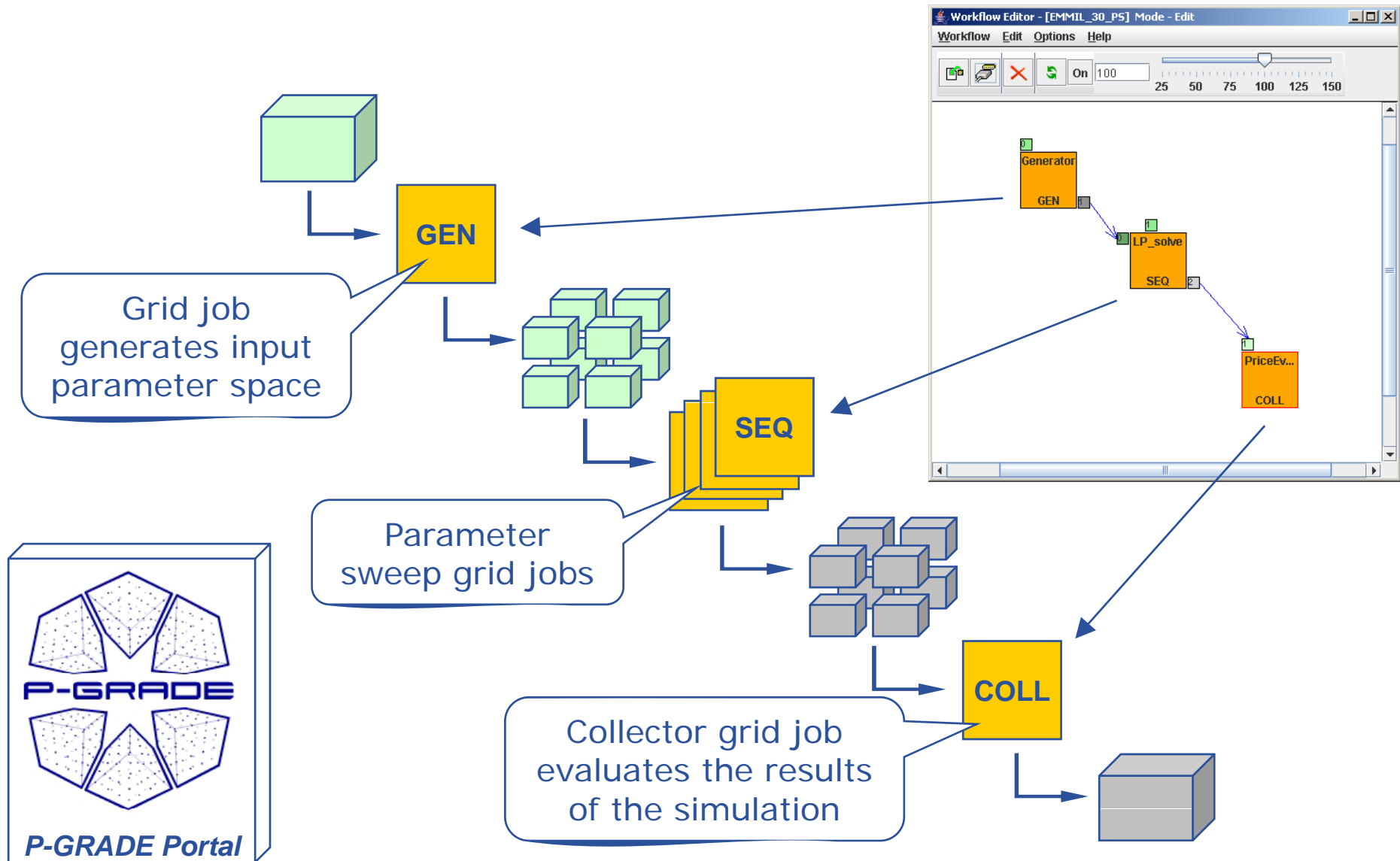
Q_i^k Purchased quantity of product i. from seller k.

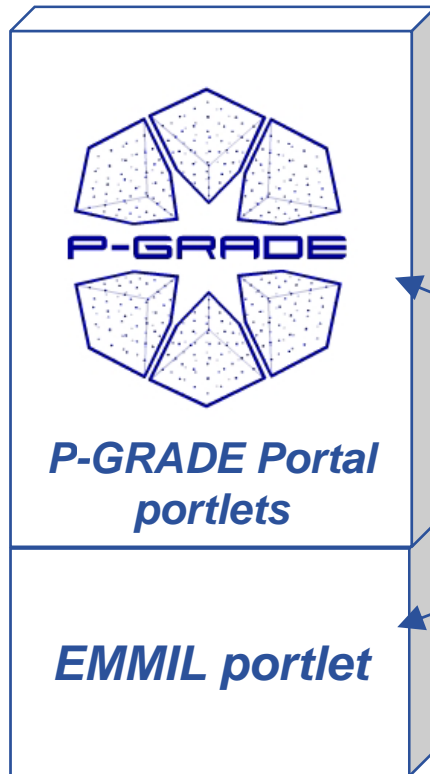
P_i^k Unit-price of product i. at seller k. as a step function of quantity

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

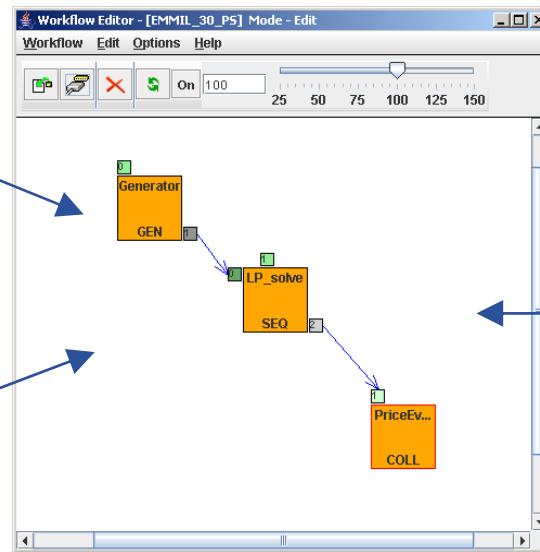
$x_j^l \in \{0,1\}$ decision variable

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





User interface

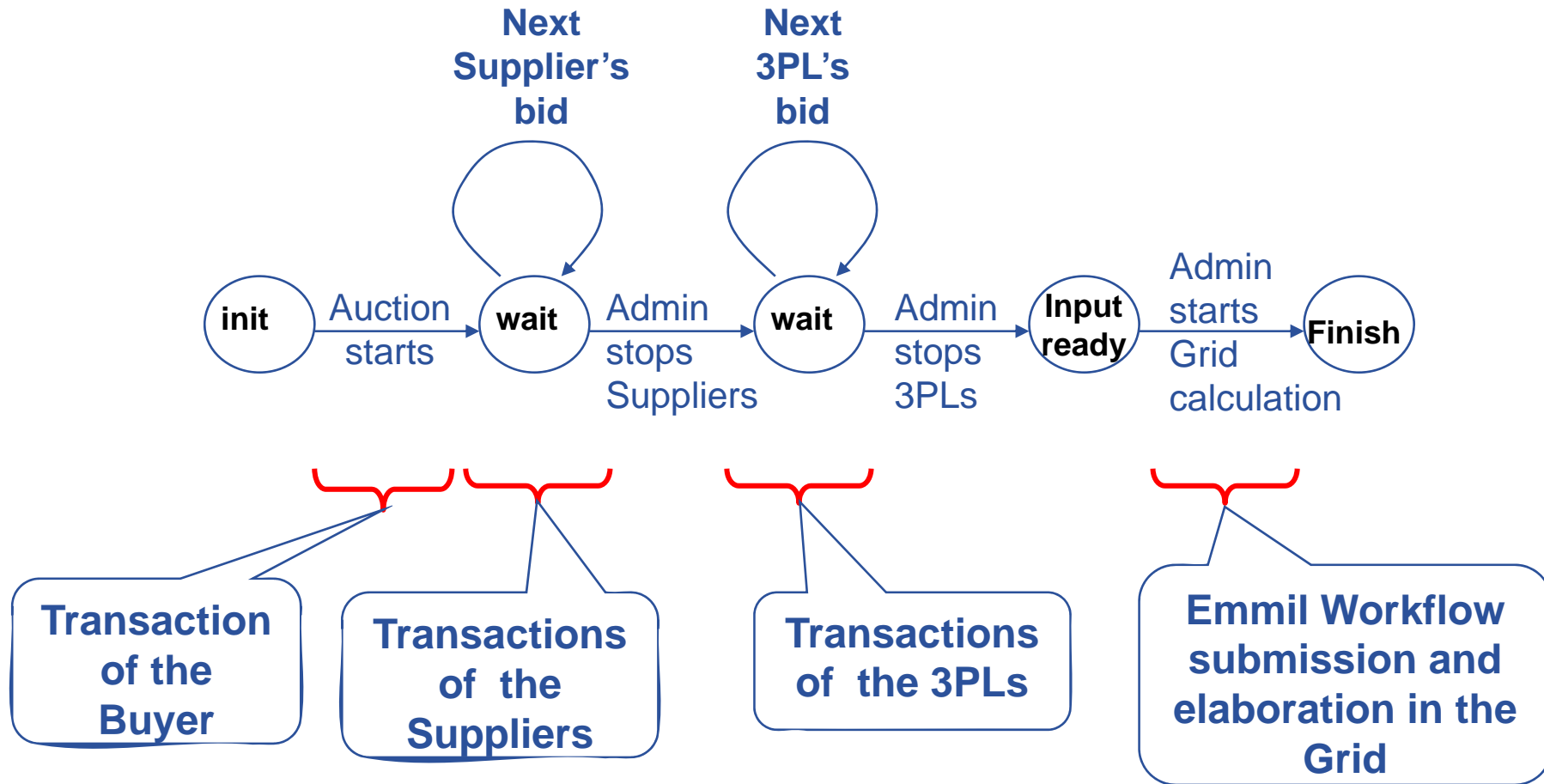


Parameter study workflow



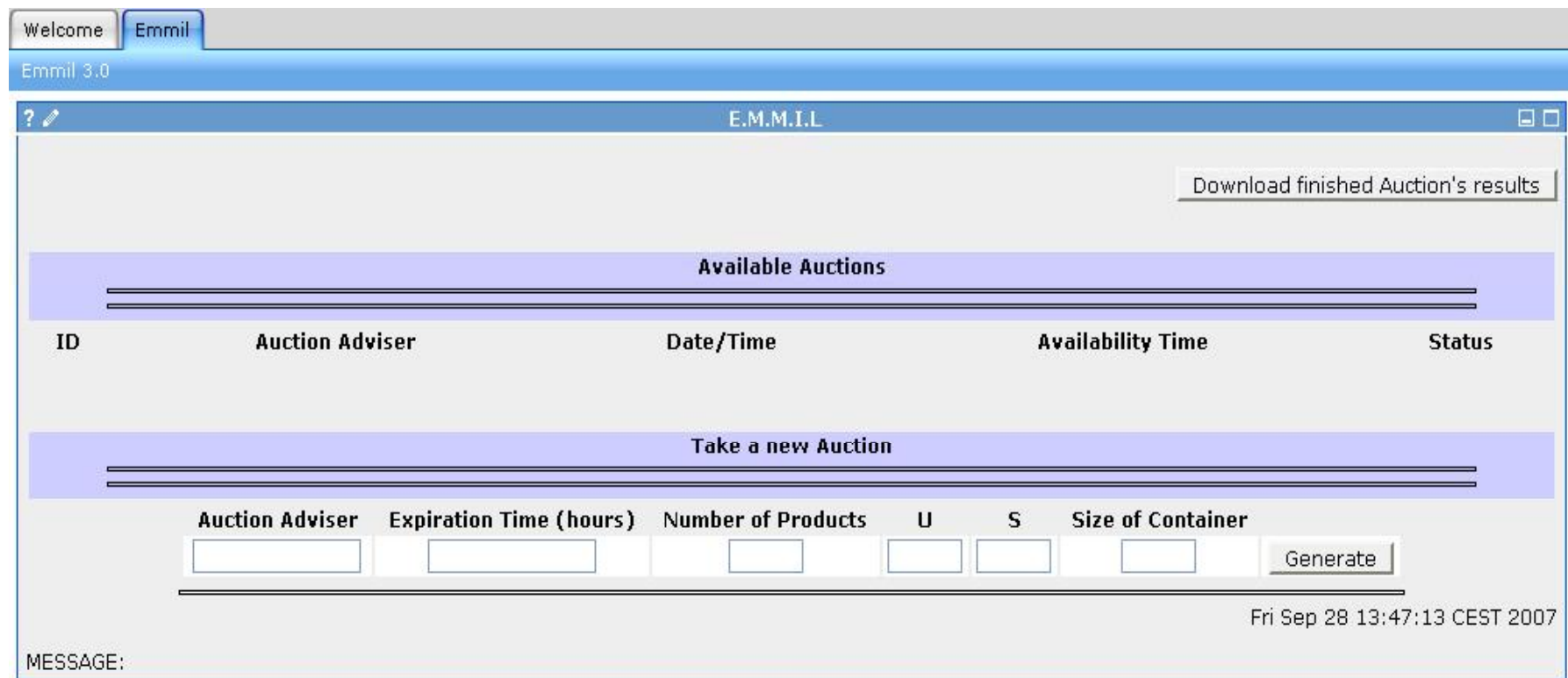
gLite based grid infrastructures

Auction: Main states of business process



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

- 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.



The screenshot shows the Emmil 3.0 web interface. At the top, there are tabs for 'Welcome' and 'Emmil', with 'Emmil' selected. Below the tabs, the text 'Emmil 3.0' is displayed. The main content area is titled 'E.M.M.I.L.' and contains a 'Download finished Auction's results' button. Below this is a section titled 'Available Auctions' which is currently empty. Underneath is a section titled 'Take a new Auction' with a form for creating a new auction. The form includes the following fields: 'Auction Adviser', 'Expiration Time (hours)', 'Number of Products', 'U', 'S', and 'Size of Container'. A 'Generate' button is located to the right of these fields. At the bottom right of the interface, the date and time 'Fri Sep 28 13:47:13 CEST 2007' are shown. In the bottom left corner, the text 'MESSAGE:' is visible.

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



The screenshot shows a web browser window with the following elements:

- Browser tabs: "Welcome" and "Emmil".
- Browser address bar: "Emmil 3.0".
- Page title: "E.M.M.I.L.".
- Section header: "New Auction Announcement".
- Table with 3 columns: "ID", "Product Name", and "Quantity".
- Table rows: 0, 1, and 2.
- Buttons: "Save".
- Timestamp: "Fri Sep 28 13:48:56 CEST 2007".
- Message: "MESSAGE: Please take a Bid".

ID	Product Name	Quantity
0	<input type="text"/>	<input type="text"/>
1	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>

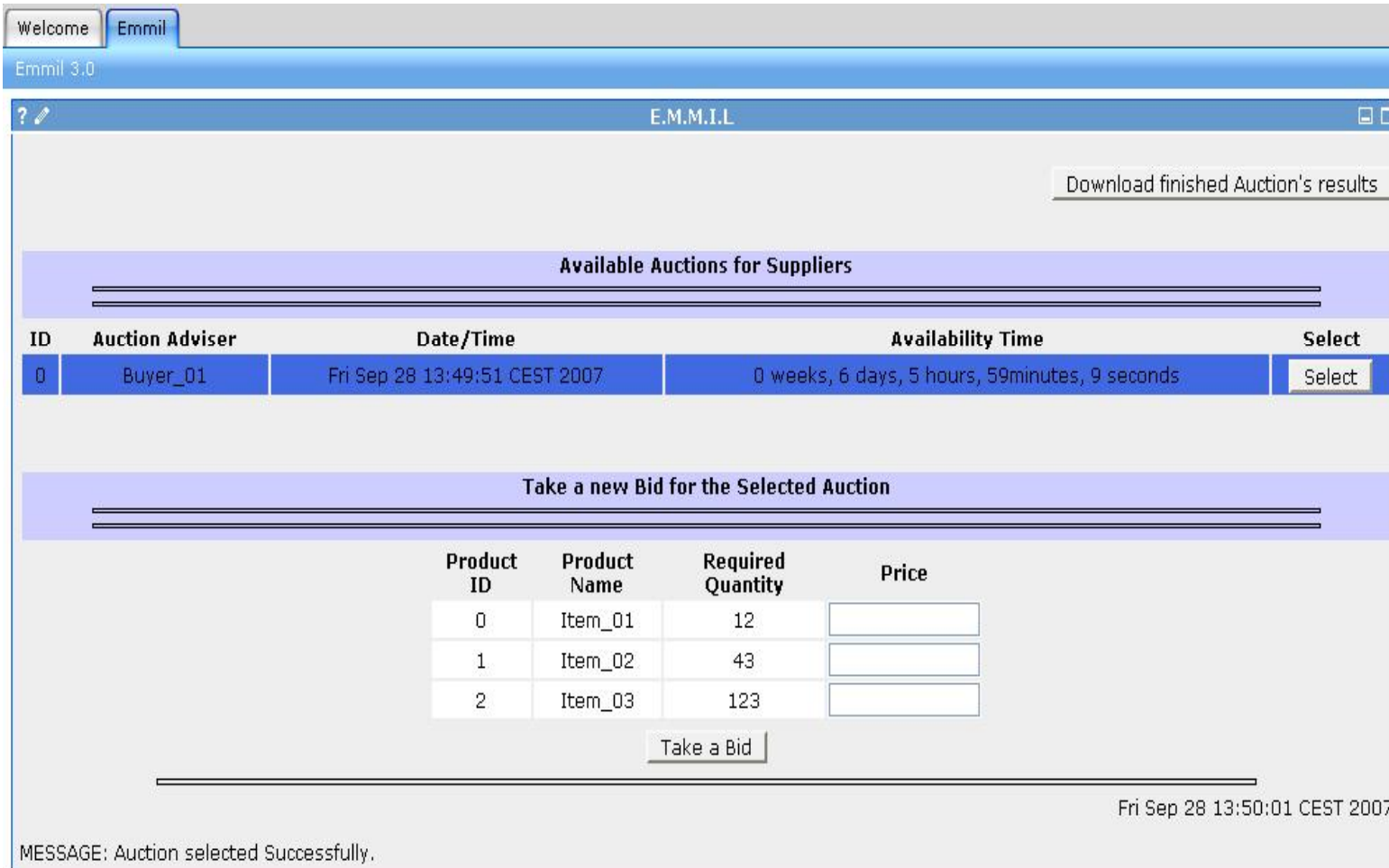
(In this case Buyer need only 3 Products.)

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

The screenshot shows a web browser window with the following elements:

- Navigation tabs: "Welcome" and "Emmil".
- Page title: "Emmil 3.0".
- Browser title bar: "E.M.M.I.L".
- Buttons: "Download finished Auction's results" (top right).
- Section header: "Available Auctions for Suppliers" (centered in a purple bar).
- Table with columns: ID, Auction Adviser, Date/Time, Availability Time, and Select.
- Table content: One row with ID "0", Auction Adviser "Buyer_01", Date/Time "Fri Sep 28 13:49:51 CEST 2007", Availability Time "0 weeks, 6 days, 5 hours, 59minutes, 49 seconds", and a "Select" button.
- Footer: "MESSAGE:" and "Fri Sep 28 13:50:01 CEST 2007".

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



Welcome | Emmil

Emmil 3.0

E.M.M.I.L

Download finished Auction's results

Available Auctions for Suppliers

ID	Auction Adviser	Date/Time	Availability Time	Select
0	Buyer_01	Fri Sep 28 13:49:51 CEST 2007	0 weeks, 6 days, 5 hours, 59minutes, 9 seconds	Select

Take a new Bid for the Selected Auction

Product ID	Product Name	Required Quantity	Price
0	Item_01	12	<input type="text"/>
1	Item_02	43	<input type="text"/>
2	Item_03	123	<input type="text"/>

Take a Bid

Fri Sep 28 13:50:01 CEST 2007

MESSAGE: Auction selected Successfully.

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



The screenshot shows the Emmil 3.0 web interface. At the top, there are tabs for 'Welcome' and 'Emmil', and a header 'Emmil 3.0'. Below this is a navigation bar with 'E.M.M.I.L.' and a 'Download finished Auction's results' button. The main content area is divided into three sections:

- Available Auctions for Suppliers:** A table with columns: ID, Auction Adviser, Date/Time, Remaining Time, Number of Bids, Set Number of Suppliers (M), and Choose. A single row is visible for 'Buyer_01' with a remaining time of '0 weeks, 6 days, 5 hours, 58minutes, 12 seconds'. The 'Choose' column contains 'Close Supplier's Auction' and 'Delete Auction' buttons.
- Available Auctions for 3PL:** A table with columns: ID, Auction Adviser, Date/Time, Remaining Time, Number of Bids, Set Number of 3PL (L), and Choose. This section is currently empty.
- Closed Auctions:** A table with columns: ID, Auction Adviser, Date/Time, Availability Time, WorkFlow, and Choose. This section is currently empty.

At the bottom right, the timestamp 'Fri Sep 28 13:51:39 CEST 2007' is displayed, along with a 'MESSAGE:' label.

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

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



The screenshot shows the Emmil 3.0 web interface. At the top, there are tabs for 'Üdvözöllek' and 'Emmil', with 'Emmil' selected. Below the tabs, the text 'Emmil 3.0' is visible. The main content area has a title bar 'E.M.M.I.L.' and a button 'Download finished Auction's results'. A section titled 'Available Auctions for 3PL' contains a table with the following data:

ID	Auction Adviser	Date/Time	Availability Time	Select
0	Buyer_01	Fri Sep 28 13:49:51 CEST 2007	0 weeks, 6 days, 5 hours, 56minutes, 45 seconds	Select

At the bottom right of the main content area, the timestamp 'Fri Sep 28 13:53:05 CEST 2007' is displayed. A 'MESSAGE:' label is located at the bottom left of the interface.

- 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)

Üdvözöllek Emmil Emmil 3.0

E.M.M.I.L

Download finished Auction's results

Available Auctions for 3PL

ID	Auction Adviser	Date/Time	Availability Time	Select
0	Buyer_01	Fri Sep 28 13:49:51 CEST 2007	0 weeks, 6 days, 5 hours, 56minutes, 4 seconds	Select

Take a new Bid for the Selected Auction

ID	Supplier Name	Fix Price	Variable Price
0	Supplier_01	<input type="text"/>	<input type="text"/>

Take a Bid

Fri Sep 28 13:53:46 CEST 2007

MESSAGE: Auction selected Successfully.

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

Emmil 3.0

E.M.M.I.L

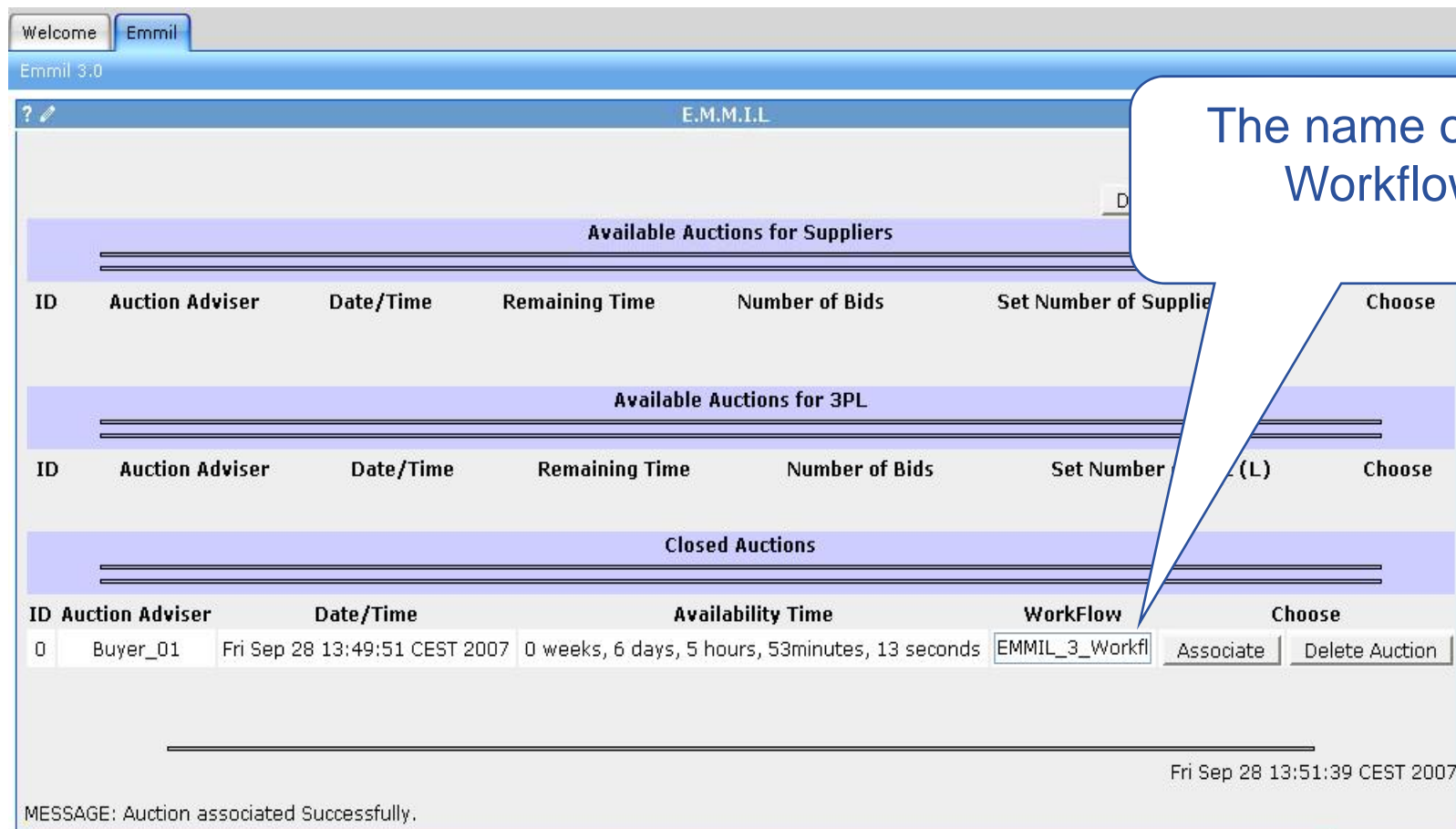
[Download finished Auction's results](#)

Available Auctions for Suppliers

ID	Auction Adviser	Date/Time	Remaining Time	Number of Bids	Set Number of Suppliers (M)	Choose
Available Auctions for 3PL						
ID	Auction Adviser	Date/Time	Remaining Time	Number of Bids	Set Number of 3PL (L)	Choose
0	Buyer_01	Fri Sep 28 13:49:51 CEST 2007	0 weeks, 6 days, 5 hours, 55minutes, 10 seconds	1	<input type="text"/>	Close Auction Delete Auction
Closed Auctions						
ID	Auction Adviser	Date/Time	Availability Time	WorkFlow	Choose	
Fri Sep 28 13:51:39 CEST 2007						

MESSAGE: Supplier's Auction closed Successfully.

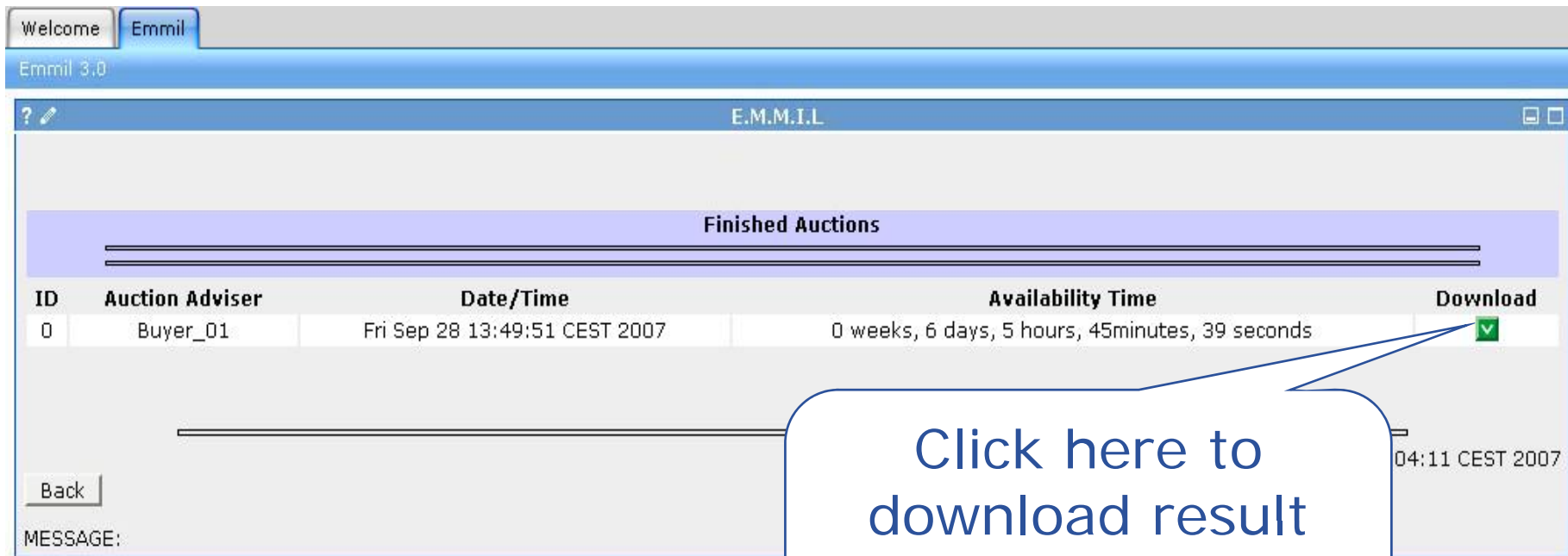
- **Associating to a Workflow. (The optimization begins now)**



The screenshot shows the Emmil 3.0 web interface. The main content area displays three tables: 'Available Auctions for Suppliers', 'Available Auctions for 3PL', and 'Closed Auctions'. The 'Available Auctions for Suppliers' table has columns: ID, Auction Adviser, Date/Time, Remaining Time, Number of Bids, Set Number of Suppliers, and Choose. The 'Available Auctions for 3PL' table has columns: ID, Auction Adviser, Date/Time, Remaining Time, Number of Bids, Set Number, (L), and Choose. The 'Closed Auctions' table has columns: ID, Auction Adviser, Date/Time, Availability Time, WorkFlow, and Choose. A callout box points to the 'WorkFlow' column in the 'Closed Auctions' table, which contains the value 'EMMIL_3_Workfl'. Below the tables, there are 'Associate' and 'Delete Auction' buttons. A message at the bottom states 'MESSAGE: Auction associated Successfully.' and the timestamp is 'Fri Sep 28 13:51:39 CEST 2007'.

The name of the Workflow

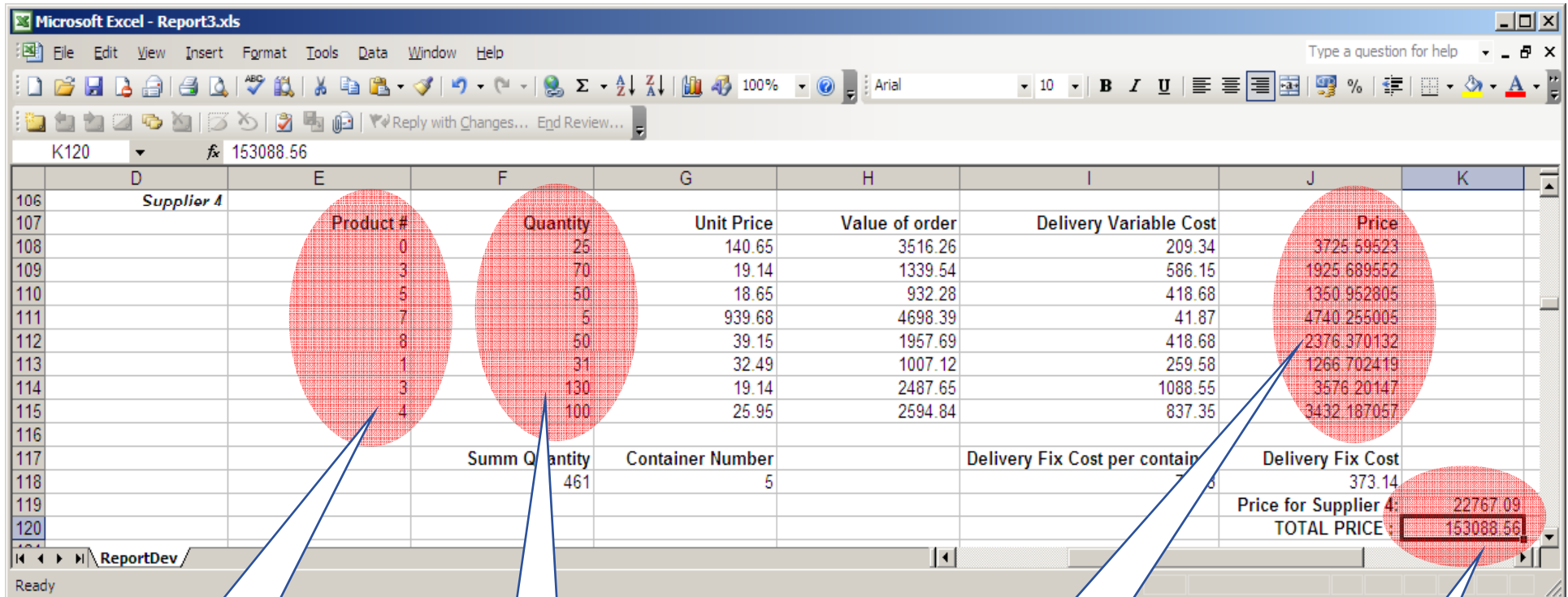
- Any user can download the results of the Auction.



The screenshot shows the Emmil 3.0 web interface. At the top, there are tabs for 'Welcome' and 'Emmil'. Below the tabs, the text 'Emmil 3.0' is visible. The main content area is titled 'E.M.M.I.L.' and contains a section for 'Finished Auctions'. This section displays a table with the following data:

ID	Auction Adviser	Date/Time	Availability Time	Download
0	Buyer_01	Fri Sep 28 13:49:51 CEST 2007	0 weeks, 6 days, 5 hours, 45minutes, 39 seconds	<input checked="" type="checkbox"/>

A callout box points to the 'Download' column, containing the text: 'Click here to download result and import it to Excel'. Below the table, there is a 'Back' button and a 'MESSAGE:' label.



Product #	Quantity	Unit Price	Value of order	Delivery Variable Cost	Price
0	25	140.65	3516.26	209.34	3725.59523
3	70	19.14	1339.54	586.15	1925.689552
5	50	18.65	932.28	418.68	1350.952805
7	5	939.68	4698.39	41.87	4740.255005
8	50	39.15	1957.69	418.68	2376.370132
1	31	32.49	1007.12	259.58	1266.702419
3	130	19.14	2487.65	1088.55	3576.20147
4	100	25.95	2594.84	837.35	3432.187057
Summ Quantity		Container Number	Delivery Fix Cost per contain		Delivery Fix Cost
461		5			373.14
Price for Supplier 4:					22767.09
TOTAL PRICE:					153088.56

Product type

Quantity to order

Price per product

Total price