E-Marketplace Model Integrated with Logistics

MTA SZTAKI
Hungarian Academy of Sciences

International Business School
Budapest

Worchester Polytechnic Institute
USA

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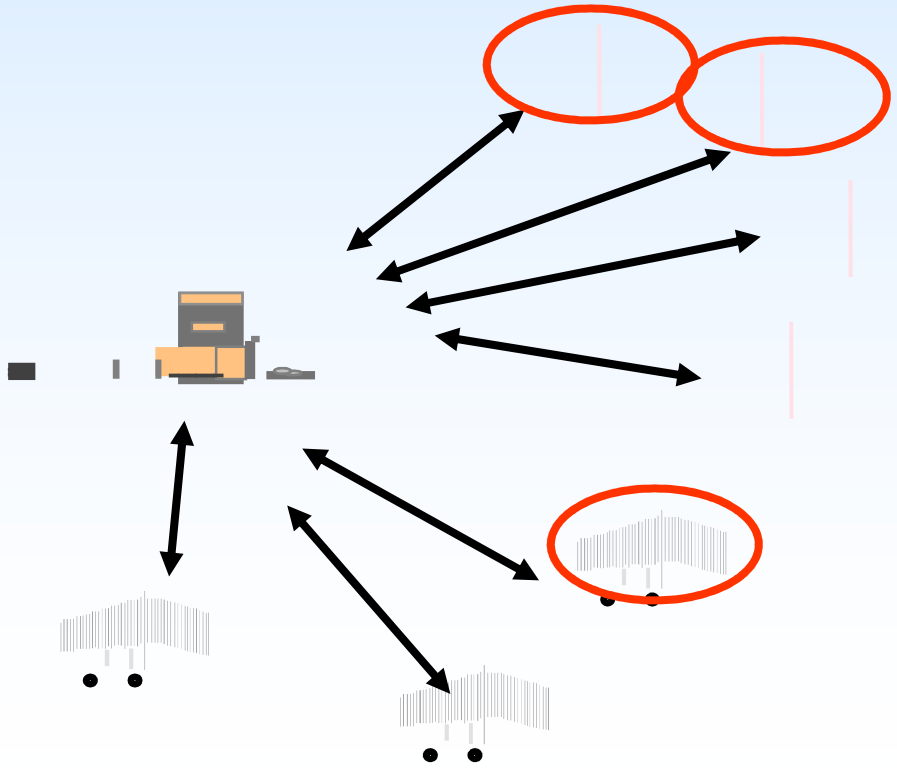
The goal

- 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

Algorithm with heuristics

Goal of heuristics: reduce problem space

- Pre-filter suppliers: keep the U best suppliers, drop the others
  - Order every product from the same supplier to find the best suppliers
- Select S suppliers from the U suppliers every possible way

combinations $\binom{U}{S}$

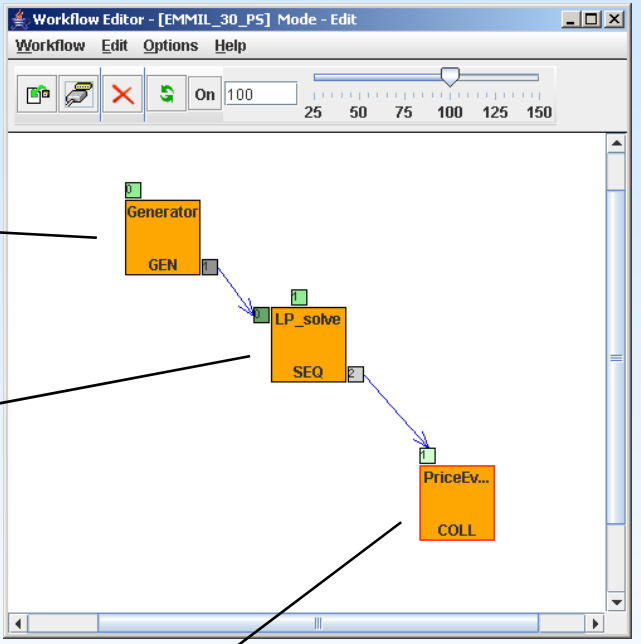
$\binom{U}{S}$

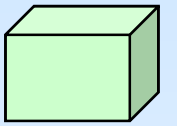
Supplier 1	Supplier 1	Supplier 1	Supplier 1	Supplier 1	. . .
Supplier 3	Supplier 3	Supplier 3	Supplier 4	Supplier 4	. . .
Supplier 4	Supplier 6	Supplier 9	Supplier 6	Supplier 9	. . .

S

- Simulate the combination of S suppliers
- Launch one grid job for every column of the table

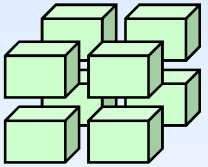
Parameter study workflow





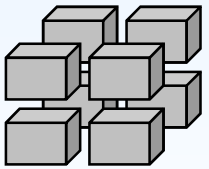
GEN

Grid job generates input parameter space



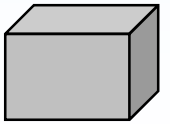
SEQ

Parameter sweep grid jobs



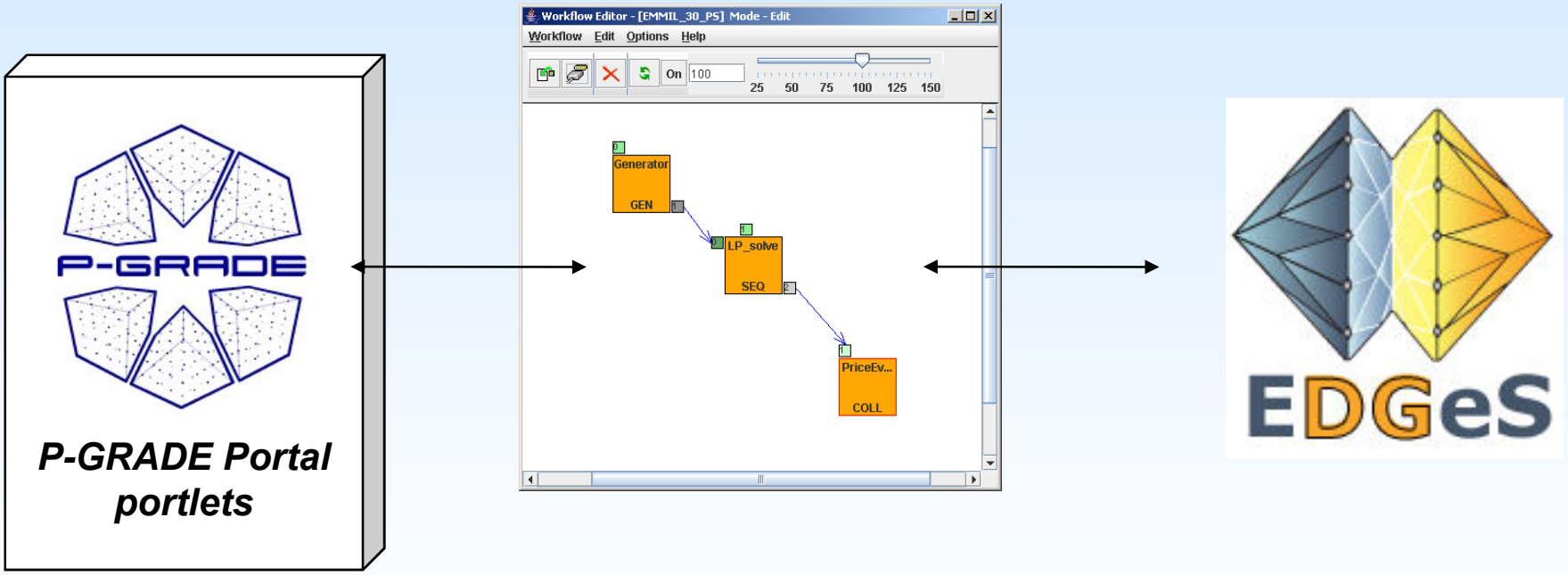
COLL

Collector grid job evaluates the results of the simulation



P-GRADE Portal

EMMIL on EDGeS



User interface

Parameter study workflow

EDGeS Integrated Infrastructure