

## Electronic Multi-Attribute Reverse Auction (eMARA)

### Advanced software for dynamic trading

CSIRO has developed eMARA (electronic Multi-Attribute Reverse Auctions), software that facilitates auctions where several sellers bid for a major contract from a major buyer on a range of features, not just price.

Multi-attribute auctions are attractive for buyers and sellers who are interested in making (buying/selling) decisions that are based on non-price attributes of the traded commodity or service. Such auctions pose new challenges as each bid involves a complex trade-off between many qualitative attributes.

eMARA provides a web-based solution that:

- Ranks competing bids for the buyer.
- Creates attractive offers for the seller to bid, taking into account the seller preferences and range of options.
- Allows all parties to keep their commercial preferences and options secret during the auction process.

This document, describes eMARA, which consists of a number of potential solutions for multi-attribute reverse B2B auctions. These include a bid evaluator, a bid generator, a bid optimiser and an automated bidding agent.

### Reverse auctions

In a *typical* reverse auction, sellers bid to provide a product or service nominated, requested and required by the buyer. The process of a time-limited price-only reverse auction begins with an auctioneer, who runs the reverse auction on behalf of the buyer. This buyer describes to the auctioneer the product or service (and conditions) that are desired. Potential sellers may then register interest in providing the goods or services with the auctioneer. The auction is conducted at an appointed time and date for a fixed period of time. Starting with an opening bid, sellers enter successively lower bids until the auction is over. Any seller can bid at any time (although not simultaneously). Finally, the buyer purchases the product or service from the seller with the best bid. The buyer then pays the auctioneer an agreed percentage of the purchase price as commission.

For a price-only reverse auction, there are several known benefits. A price-only reverse auction:

- Is easily understood by participants;
- Can be conducted over the internet (geography is no barrier);
- Is popular in many markets (especially commodity markets);
- Allows buyers to take advantage of their buying power by setting the terms of the market;
- Often results in a low-cost sales channel for sellers;
- Provides flexibility — variations can be customized to many markets;

Moreover, the hypothesis is that the auction process is fun and/or exciting for the sellers.

But a price-only reverse auction has the following major limitation:

***In non-commodity markets sellers are loath to compete on price alone.***

To make reverse auctions viable in non-commodity settings it is necessary to lift the restriction on price-only bids, while striving to keep the process simple and attractive to participants.

Therefore, there are several factors that need to be satisfied:

- High quality suppliers don't want to be judged on price only;
- Buyers like to deal with reputable suppliers – but still want competitive deals;
- Measurement of non-price factors is difficult;
- Auction volumes and frequency is likely to be high; and
- Suppliers need support in formulating bidding strategies for price and non-price attributes, and then (semi-) automated bidding.

Also a number of additional interesting issues and questions arise:

- How does the auctioneer compare bids;
- What constitutes an acceptable bid;

- How does a seller time and formulate a bid; and
- What information is disclosed.

In arriving at answers to these questions and issues, CSIRO developed the eMARA framework as well as the eMARA software solution.

## CSIRO eMARA Framework

CSIRO has developed a modelling framework for carrying out automated multi-attribute reverse auctions. This framework has been embedded in eMARA, an advanced software solution for dynamic trading in e-commerce applications.

eMARA envisages and adopts the following requirements:

- Careful selection of non-price attributes and criteria (derived in consultation with buyers and sellers – add-value consulting services);
- Bidding with price and non-price attributes (with constraints);
- Allocation rules built on buyer's preferences (e.g. allow to select from 3 best bids – best non-price rank amongst best 3 prices);
- Generic solution but customisable for markets (e.g. generic attributes: reliability, service value, support, performance); need to define utility functions and efficiency surfaces (explicit and implicit); and
- Defining and executing bidding preferences/strategies for suppliers.

To confirm the reality of the requirements and the framework, CSIRO developed a focused application for electronic multi-attribute reverse auctions in the broadband market.

A pilot software system was developed consisting of the following modules:

- The Buyer Negotiable Parameters Module that allows Buyers to adequately specify suitable bounds for each of the negotiable parameters as well as specific weights and additional parameters for the auction. This information specified here tend to be static during the course of an auction, although it will have substantial influence on the auction bidding processes.
- The Seller Performance Capabilities Module that specifies the important decision support parameters for the bounds and cost structure, essential for the seller auction bidding process. This information may be established prior to bidding and may be updated during the course of the auction.
- The Seller Performance Bidding Module that provides an interactive decision support interface and optimization schemes during the seller auction bidding process. The seller may exploit any of the Bid Optimization Modes to spawn decision support information and submit the auction bids.
- Auction Bidding Feedback Module that supplies feedback on how the auction bidding is progressing. It has three major tasks, that is: to regularly present the bid history table to the user interface; to launch the generation of the bid history graphical images; and to present the graphical images to the user interface.

The software runs on an internet-based platform, accessible through web server scripts and integrates with

- a mathematical solver: used to optimise the negotiations, and
- a graphical toolkit: used to give feedback on the current status and progression of the auction.

A demonstration of this software is available and can be presented on request. It can be directly accessed online through a web browser and the participants can be distributed in different locations.

Other applications for this software exist in market evaluation and business management. The processes and outcomes of preparing an auction provide a worthwhile feedback and analysis on the practical behaviours of the market. Through this understanding, business processes can be designed and improved. Additionally, the software can be adapted to aid decision-making in other contexts (e.g. bi-lateral negotiation), as well as provide helpful quantitative analysis of the structures of buyer's and seller's companies. Lastly, the software can also be extended to other parts of the supply chain.

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