Applicant Auction
Beijing Workshop

Using auctions to resolve string contentions efficiently and fairly in a simple and transparent process

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Cramton Associates

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@ApplicantAuc
28 March 2013
The top-level domains (strings)
The applicants (bidders)
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Applicant Auction Plan

Auction design (August to December)
- Development
- Testing
- Education

First auction consultation (December to April)
- Conference and mock auction (18 Dec, Santa Monica)
- Consultation

First Applicant Auction (late April)
- First commitment
- Mock auction
- Live auction
- Settlement

Second Applicant Auction (July)
- Second commitment
- Mock auction
- Live auction
- Settlement

Third Applicant Auction (September)
- Third commitment
- Mock auction
- Live auction
- Settlement
Example

Early domains .early
- First Applicant Auction Conference 18 Dec 2012
- First Commitment date 17 Apr 2013
- First Applicant Auction 29 Apr 2013

Before Initial Evaluation
Save $65k

Later domains .late
- Third Applicant Auction Webinar 14 Aug 2013
- Third Commitment date 28 Aug 2013
- Third Applicant Auction 9 Sep 2013

After Initial Evaluation
Resolve uncertainty

Early domains: First Applicant Auction Conference on 18 Dec 2012, followed by a first commitment date on 17 Apr 2013, and a second auction on 29 Apr 2013.

Later domains: Third Applicant Auction Webinar on 14 Aug 2013, followed by a third commitment date on 28 Aug 2013, and a final auction on 9 Sep 2013.

Before initial evaluation, there is a saving of $65k.

After initial evaluation, uncertainty can be resolved.
Key benefits of applicant auctions

• *Avoids delay and value loss from ICANN Last Resort Auction*
• Maximize value of domains (puts them to their best use)
• Rapidly resolve contention leading to faster ICANN assignment
• Allow the applicants retain benefits of resolution, rather than sharing benefits with ICANN
• Lower price paid by buyer (applicant with highest bid)
• Compensate sellers (applicants with lower bids) with a share of buyer’s payment
Auction objectives

- **Efficiency.** Auction maximizes applicant value
- **Fairness.** Auction is fair. Each applicant is treated the same way; no applicant is favored in any way
- **Transparency.** Auction has clear and unambiguous rules that determine the allocation and associated payments in a unique way based on the bids received
- **Simplicity.** Auction is as simple as possible to encourage broad participation and understanding
Prototype auction designs

- Sequential first-price sealed-bid auction
- Simultaneous ascending clock auction

Both approaches have proven successful when auctioning many related items
Conclusions of design team

• Both auction formats perform well
  – About 98% of potential value is realized

• Preference for simultaneous ascending clock
  – Better price discovery
  – Better deposit management
  – Reduced tendency to overbid
  – More consistent with ICANN Last Resort Auction
Auction details
Addressing the holdout problem

• Applicant must make a binding commitment to participate in Final Applicant Auction by commitment date
  – Applicant agrees to participate in auction for the strings applicant specifies in its participation set
  – For strings in the applicant’s participation set lacking unanimous participation, applicant agrees to wait until the ICANN Last Resort Auction to resolve string contention

• Commitment removes “holding out and negotiating with other applicants” as a viable alternative

• All should participate since the Applicant Auction dominates the ICANN auction for all applicants
Small guys need big guys

Big guys need small guys
Contracts

ICANN
Neutral
Market facilitator
Cramton Associates

Applicant 1
Donuts
Applicant 2
Amazon
Applicant 3
Google

…
Deposit

- A 20% deposit is required to assure that bids are binding commitments
- Bids may not exceed five times current deposit
- Deposit may increase during auction
  - As a result of selling domain rights
    (real-time credits to escrow account)
  - As a result of deposit top-ups
    (credited at end of business day)
- Deposit is held in escrow account at major international bank (Citibank)
Settlement

• Within 8 business-days of auction end, settlement is executed by the settlement agent, a major international law firm working with the major international bank.

• At no time does the market facilitator have access or take title to deposits, settlement amounts, or domain rights.
Mock auction
87 strings

size indicates number of applicants
16 bidders
size indicates number of applications
Auction rules

Simultaneous ascending clock

- All 87 domains will be sold simultaneously in multiple rounds. In each round, for each domain, the number of active bidders is announced together with two prices: (i) the **minimum price to bid**, and (ii) the **minimum price to continue**. The **minimum price to bid** is where the auction has reached at the end of the last round (or $0 in the first round). You are already committed to a bid of at least this amount, which is why this is the lowest bid you may place. The **minimum price to continue** is the smallest bid that you may place in the current round in order to be given the opportunity to bid in the next round. Thus, for each domain of interest, the submitted bid indicates your decision to either exit in the current round with a bid that is between the **minimum price to bid** and the **minimum price to continue**, or continue with a bid that is at or above the **minimum bid to continue**, in which case you will be given the opportunity to continue bidding on the domain in the next round. In other words you may:

  - **Exit** from a domain by choosing a bid that is less than the announced **minimum price to continue** for that round. A bidder cannot bid for a domain for which she has submitted an exit bid.
  - You may **continue** to bid on a domain of interest by choosing a bid that is greater than or equal to the announced **minimum price to continue** for that round.
Mechanics of bidding

- **Round 1**
  - Round 1 opens
  - Bidders submit bids
  - Round 1 closes
  - Results for Round 1 posted and Start-of-Round Prices for Round 2 announced
  - End-of-Round Prices for Round 2 announced

- **Round 2**
  - Round 2 opens
  - Bidders submit bids
  - Round 2 closes

- **Start-of-Round and End-of-Round Prices**
  - for Round 1 announced
  - for Round 2 announced

- **Time**
  - about 30 mins (preannounced)

**Recess**

- about 30 mins (preannounced)
**Sequence of rounds**

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<th>Round</th>
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<td>Recess</td>
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Second pricing

Price

Demand

Maximum Blue Bidder is willing to pay (highest)

Maximum Green Bidder is willing to pay (second highest)

Blue Bidder pays this price
Symmetric values (ex ante)

• For each string and each bidder, bidder’s value for string is randomly and independently drawn from $0 to $5000k with all values equally likely

• These values are private—each bidder will know only his own value
Profits

- Profit from domain won:
  \[ \text{Profit}_{\text{won}} = \text{value} - \text{price} \]

- Profit from domain lost, where \( n \) is the initial number of bidders for the domain:
  \[ \text{Profit}_{\text{lost}} = \frac{\text{winner’s payment}}{n - 1} \]
Profits (examples)

• Suppose that your valuation for the domain is 4500k and you win it at a price of 4000k. Then your profit from this domain is equal to 4500k – 4000k = $500k.

• Suppose that you lose the domain, the initial number of bidders for that domain is 5, and the winner pays $4000k. Then your profit from this domain is equal to 4000k / 4 = $1000.
Deposit

• Each bidder has an initial deposit. The size of the deposit determines the maximum bidding commitment the bidder can make. The total of active bids and winning payments cannot exceed five times the current deposit. As domains are sold, the payment received by the loser is added to the deposit amount. Also for domains that have not yet sold but for which the bidder has exited, the bidder’s deposit is credited with the minimum payment that the bidder may receive once the domain is sold—this is the *minimum price to bid* in the current round.

• The auction system will prevent a bidder from placing bids on a collection of domains that would cause the bidder’s total commitment to exceed five times the bidder’s current deposit.
Bidding strategy

Symmetric second-price auction

• Some results from auction theory about *single item auctions* that may be relevant when devising your bidding strategy

• Some notation
  
  – $n$ bidders with bidder $i$ assigning a value of $V_i$ to the object
  
  – Each $V_i$ is drawn independently on the interval $[0, \bar{v}]$ according to the cumulative distribution function $F_i$ with a positive density $f_i$
Bidding strategy

**Symmetric second-price auction**

• Standard private-value setting where winning payments are retained by the auctioneer, the second-price and ascending clock auctions both have the same dominant strategy equilibrium: bid (up to) your private value, or \( b(v) = v \).

• Bidder incentives change in our setting where the winner’s payment is shared equally among the losers (sellers)
  – Losing is made more attractive in this case,
  – Loser receives a share of the winner’s payment, rather than 0
Bidding strategy

**Symmetric second-price auction**

- With symmetric bidders with values independently drawn from the uniform distribution, there is a unique symmetric equilibrium for the second-price domain auction. It is

\[
b(v) = \bar{v} \left( \frac{n \frac{v}{\bar{v}} + 1}{n(n+1)} \right) .
\]
Bidding tool
Bidding tool

• Provides generic bidding tool (Excel workbook)
  – All domains (rows)
  – Number of bidders by domain
  – Eligibility of each bidder by domains
  – Value by domain (bidder pastes her private information into tool from auction system)
  – *Equilibrium bid from one-item auction without budget constraints*
  – “Your bid” by domain
  – Upload integration with auction system
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Results from mock auction
Nearly maximal value achieved
Nearly equal buyer and seller split

Buyers’ share

51.7%

48.3%

Sellers’ share

43.3%

56.7%
Tendency to bid too truthfully

Those with high values bid higher than profit maximizing level.

Those with low values bid lower than profit maximizing level.
Bid function too steep \( (n = 2) \)
Bid function too steep (n = 3)
Bid function too steep (n = 4)
Limitations of analysis

• Actual auction setting will have more uncertainty than assumed here
  – Value distributions will not be commonly known
  – Values will be positively correlated, not independent
  – Some bidders may be less sophisticated than others
• Uncertainty will introduce guesswork, which likely will limit efficiency
• However, since ascending auctions outperform first-price sealed-bid auctions in settings with greater uncertainty and value correlation, these complications seem to reinforce our conclusion: *the simultaneous ascending format most likely is best*. 
Theoretical and experimental testing of alternative auction designs

Background
The power of mechanism design:

*Equal shares supports efficiency and fairness objectives*

• Assume:
  – Each bidder’s value is drawn independently from the uniform distribution on $[0, v_{\text{max}}]$  
  – Each bidder seeks to maximize dollar profit  
  – High bidder wins; non-high bidders share winner’s payment equally  
  – Consider 1st-price and 2nd-price pricing rules

• **Proposition.** *There is a unique equilibrium, the outcome is ex post efficient, and each bidder’s profit is invariant to the pricing rule (revenue equivalence).*

• **Proof.** Direct calculation results in a unique increasing equilibrium. Efficiency then is obvious. Revenue equivalence holds because the interim payment of the lowest-value bidder is invariant to the pricing rule.
But revenue equivalence does not hold for all distributions

• Assume:
  – Each bidder’s value is drawn independently from the same distribution $F$ with positive density $f$ on $[0, v_{\text{max}}]$
  – Each bidder seeks to maximize dollar profit
  – High bidder wins; non-high bidders share winner’s payment equally
  – Consider any pricing rule (e.g. 1\textsuperscript{st} price, 2\textsuperscript{nd} price, ... ) that results in an increasing equilibrium bid function

• **Theorem.** The outcome is ex post efficient. However, a bidder’s expected profit depends on the pricing rule (revenue equivalence fails).

• **Proof.** Efficiency is obvious. Revenue equivalence does not hold because the interim payment of the lowest-value bidder is non-zero and depends on the pricing rule.
Counter example of revenue equivalence

• Consider an auction with three bidders whose values are distributed according to $F(x)=x^2$
• As shown, expected payments of a bidder with zero value differ in first- and second-price auctions

Expected payment; 1st price blue, 2nd price purple

Low-value bidders prefer 1st price sealed-bid in this example
Experimental testing
Treatments: $2 \times 2$ experimental design

• 2 auction formats
  – Sequential first-price sealed-bid
  – Simultaneous ascending clock (second price)

• 2 value distributions (independent private value)
  – Symmetric (uniform from 0 to $5000k$)
    • 16 bidders, mean value = $2500k$
  – Asymmetric (triangle distribution from 0 to $5000k$)
    • 3 large strong bidders, mean = $3750k$
    • 13 smaller weak bidders, mean = $1250k$
Bidding for Amazon - Round 2

Your Bid must be at least the Minimum Price to Bid. In order to Continue, your Bid must be greater than or equal to the Minimum Price to Continue.

In the next Round, you will no longer be able to bid on those Domains that are marked "Exit".

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<th>Current Limit: $42,250k</th>
<th>Total Commitment: $8,220k</th>
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You may submit a new Bids File

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<th>Bid</th>
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<td>.dev</td>
<td>2</td>
<td>$1,020k</td>
<td>$1,448k</td>
<td>$1,126k</td>
<td>$880k</td>
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<td>.you</td>
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<td>$1,020k</td>
<td>$1,448k</td>
<td>$2,060k</td>
<td>$3,680k</td>
</tr>
</tbody>
</table>

Note:

- "Still Bidding" is the number of Bidders with Bids of at least the Minimum Price to Bid of this Round at its start time.
- Continue: You will be able to bid for this Domain next Round.
- Exit: You will not be able to bid for this Domain next Round.
Experimental results
Clearing round and prices

In sequential, by construction, about the same number clear in each round.

In simultaneous, strong tendency for highest value domains to clear last, allowing better budget management.
Efficiency: ratio of realized to potential value

Both auction formats are highly efficient

<table>
<thead>
<tr>
<th></th>
<th>Sequential Value-a</th>
<th>Sequential Value-b</th>
<th>Symmetric Value-a</th>
<th>Symmetric Value-b</th>
<th>Simultaneous Value-a</th>
<th>Simultaneous Value-b</th>
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</thead>
<tbody>
<tr>
<td>Group-1</td>
<td>98.1%</td>
<td>99.0%</td>
<td>99.1%</td>
<td>98.4%</td>
<td>97.0%</td>
<td>98.5%</td>
</tr>
<tr>
<td>Group-2</td>
<td>99.1%</td>
<td>98.4%</td>
<td>98.5%</td>
<td>97.6%</td>
<td>98.5%</td>
<td>98.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Sequential Value-c</th>
<th>Sequential Value-d</th>
<th>Asymmetric Value-c</th>
<th>Asymmetric Value-d</th>
<th>Simultaneous Value-c</th>
<th>Simultaneous Value-d</th>
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</thead>
<tbody>
<tr>
<td>Group-1</td>
<td>96.3%</td>
<td>97.7%</td>
<td>97.1%</td>
<td>98.0%</td>
<td>98.6%</td>
<td>98.3%</td>
</tr>
<tr>
<td>Group-2</td>
<td>98.2%</td>
<td>98.0%</td>
<td>98.0%</td>
<td>98.6%</td>
<td>98.3%</td>
<td>98.3%</td>
</tr>
</tbody>
</table>

Ratio of realized to potential value
Deviation in bids from theory

In sequential, bidders tend to overbid.

In simultaneous, bidders tend to underbid.
In simultaneous, bidders tend to underbid in both cases.

Black: Actual = Equilibrium
Blue: Trend of actual with ±5% confidence band

In sequential, bidders tend to overbid in symmetric, but not asymmetric case.
Human and equilibrium bid functions (symmetric)

In simultaneous, bidders tend to underbid. In sequential, bidders tend to overbid.

Trend with ±5% confidence band.

Equilibrium bid