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Secure Supply-Chain Collaboration (SSCC)

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SSCC and Supply-Chain Management

- Information-Sharing is Revolutionizing Supply-Chain Management
- But Buyers and Sellers are *Afraid* to Share Information
 - Fear of Leakage to a Competitor
 - Fear that "Partner" will take Advantage
- Under SSCC Protocols Partners can make Collaborative Decisions *without* Divulging any Private Information

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The Benefits of SSCC

- Increased Supply-Chain Profit
- Reduction in:
 - Unnecessary Capacity
 - Unwanted Inventory
 - Quoted Leadtimes
- Better Customer Service
- Potential to Revolutionize Supply-Chain Practice

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Research Issues

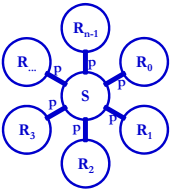
- Required Information and Decision-Rules
- Protocol design
- Trade off between Level of Security and Cost
- Choice of Architecture

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Example: Bidding and Auctions

- Pricing:
 - Non-Discriminatory versus Discriminatory
- S=Supplier; R_i=Retailer i
- Architectural Issues
- E-commerce Scenarios, Frameworks
- How to keep participants honest



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Non Discriminatory Clearing

- Each retailer i has one (p_i, q_i) pair
- Supplier has a supply curve $q = p + \theta$
- The fixed price would be $p = \Sigma q_i - \theta$
- Only retailers with $p_i < p$ are allowed to pull out

Who learns what	(p_i, q_i)	$(p_j, q_j), j \neq i$	θ	Σq_i	p
Supplier			✓	✓	✓
Retailer i	✓				✓

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Pick and Choose

- The seller can sell at most K identical units.
- Each retailer has a number of price-quantity pairs (gets only one).
- Find the minimum number of units to be sold with the maximum possible seller's revenue.

Who learns what	(p_i, q_i)	$(p_j, q_j), j \neq i$	K
Supplier			✓
Retailer i	✓		✓

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All or Nothing

- Each retailer i has one (p_i, q_i) pair
- Supplier has a supply curve $q = p + \theta$
- Supplier is to accept all bids or none
- Is $\sum p_i q_i \geq (\sum q_i - \theta)(\sum q_i)$?

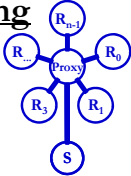
Who learns what	(p_i, q_i)	$(p_j, q_j), j \neq i$	θ	$\sum q_i$	$\sum q_i - \theta$	$\sum p_i q_i$
Supplier			✓			
Retailer i	✓					

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Discriminatory Pricing

- Filling an order from retailer i reveals to the seller (p_i, q_i) . This reveals the retailer demand curve!
- Buyer's proxy



Who learns what	(p_i, q_i)	p_i	q_i	$p_j, j \neq i$	$q_j, j \neq i$	$\sum q_i$
Supplier			✓			✓
Proxy				✓		
Retailer i	✓	✓	✓			

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Capacity Allocation Models

- Proportional Allocation
 $q_i = \{q_i, Kq_i / \sum q_i\}$
- Linear Allocation
 $q_1 \geq q_2 \geq \dots \geq q_N$
 $q_i = q_i - \max\{0, \sum_0^i q_i - K\} / v$

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Ongoing and Future Work

- Enhancing protocols' performance
- Other capacity allocation models
- Collusion resistance
- Auditability
- Non-repudiation
- Multi-supplier scenarios
- Multi-commodity (combinatorial) scenarios

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