The Optimization Problem behind Collateral Management

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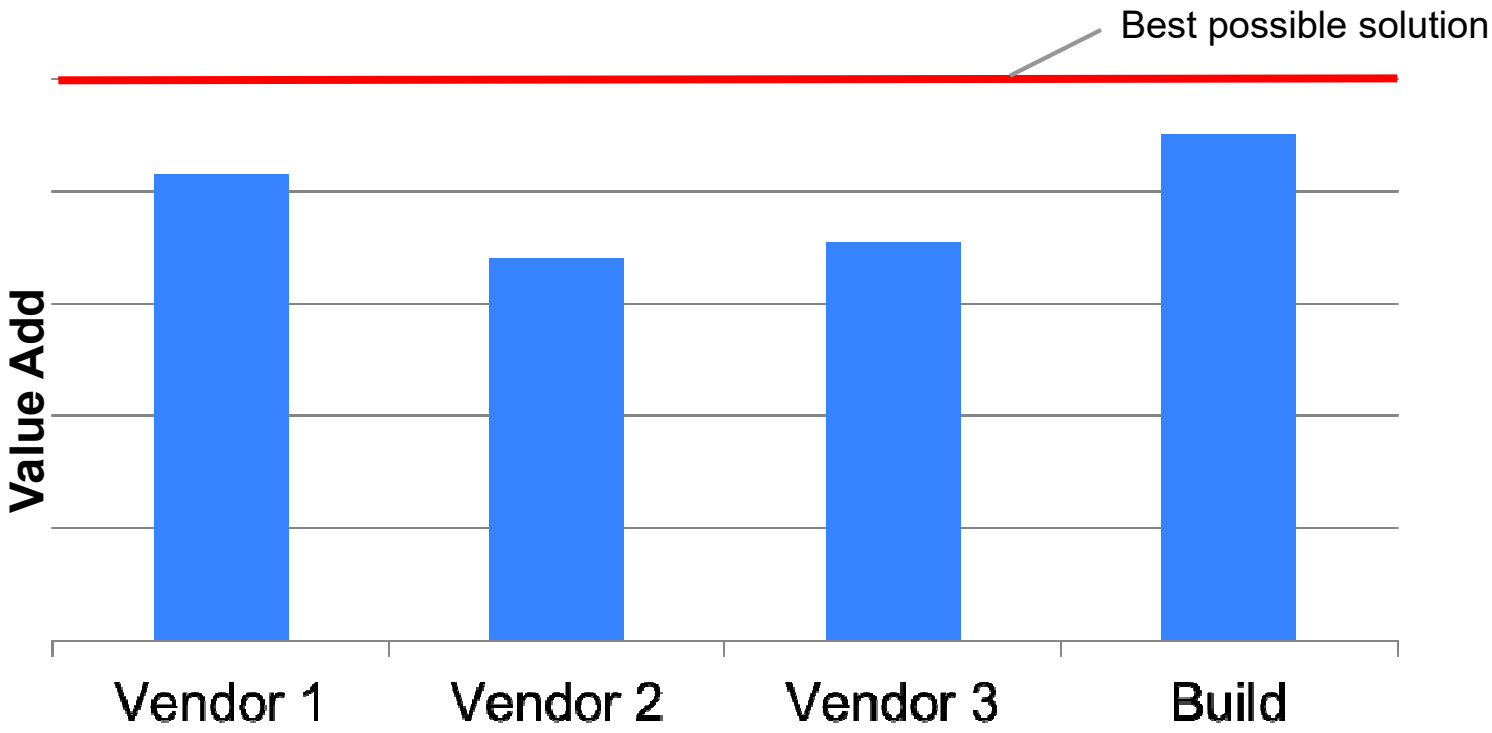
The Optimization Problem behind Collateral Management

Agenda

- Optimization philosophy
- *Cheapest to Deliver* optimization
- Issues with C*heapest to Deliver* optimization
- *Collateral Substitution* optimization
- Issues with C*ollateral Substitution* optimization
- Questions

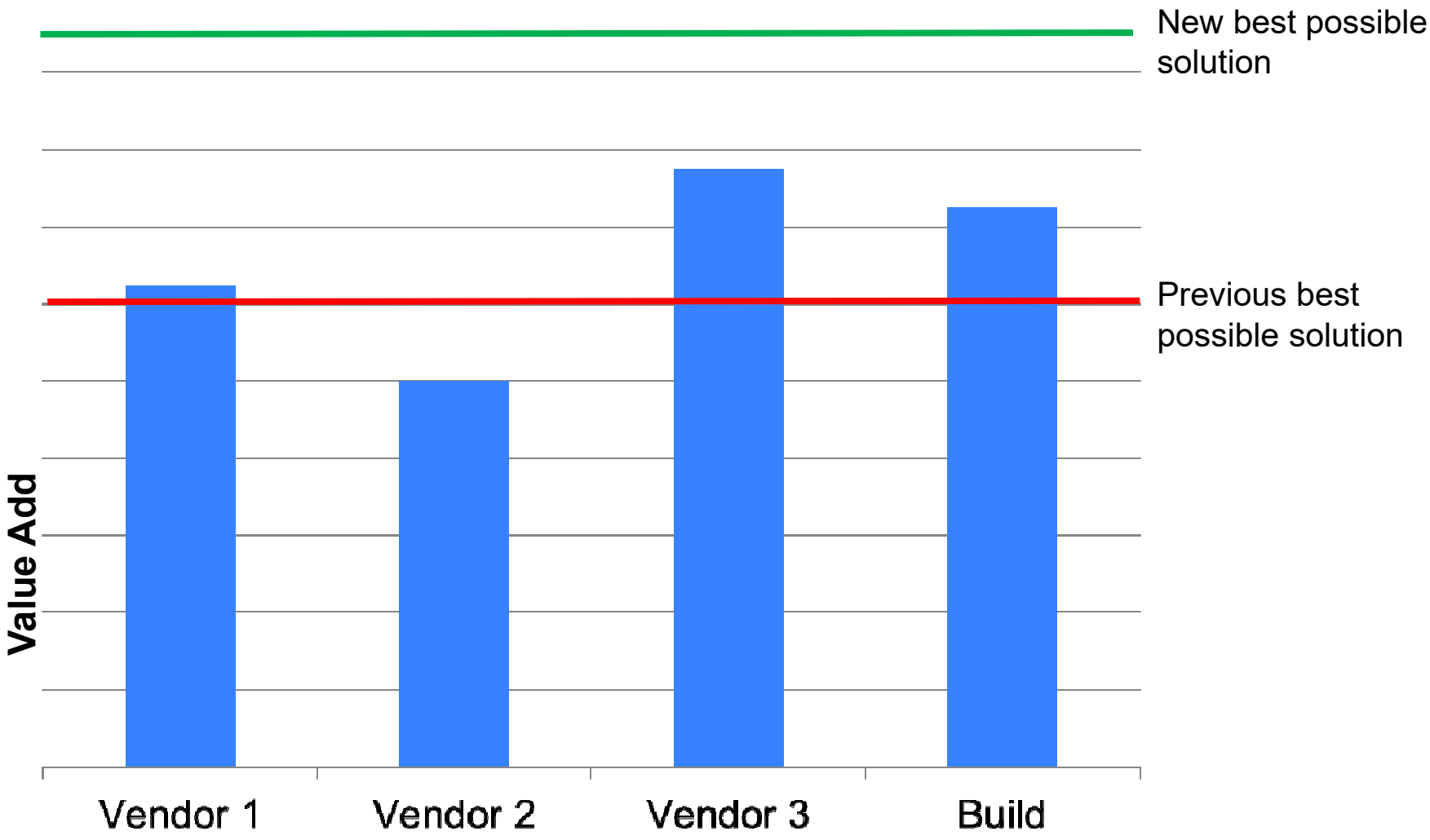
Optimization philosophy

- *Everyone is asking:* what is the best collateral optimization software?
- There are notable differences among packages
- Regardless of the package, or whether you develop your own, there is a theoretically best possible solution, given the operational and data constraints
- No software is going to do better than the theoretically best possible solution



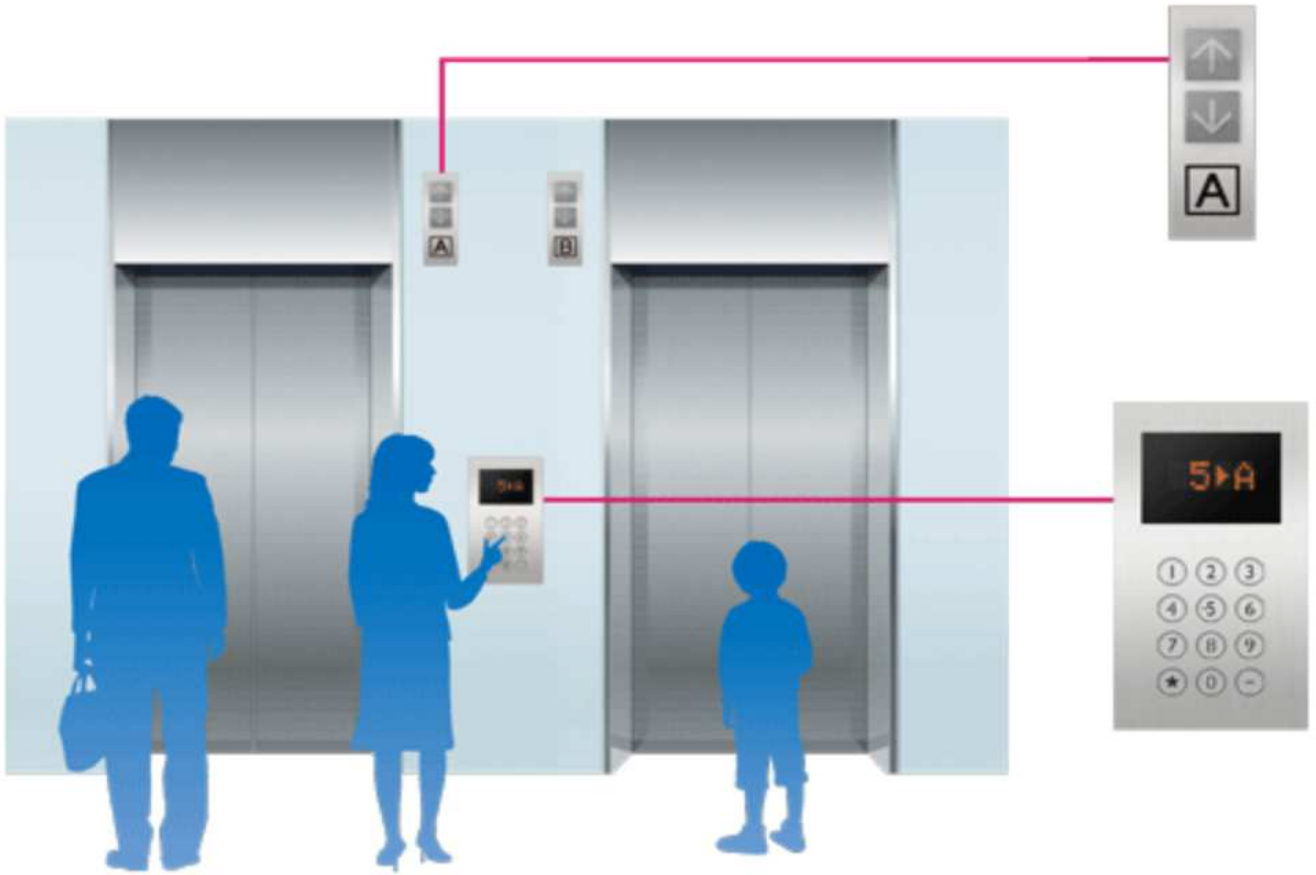
Optimization philosophy

Change the problem being solved.
Improve the best possible solution and all alternatives can do better



Optimization philosophy

Here is an analogy from a very different industry – that competes on optimization, and has a long history of changing the problem



- Move the floor selector to the lobby
- It's an operational change, but not onerous
- Vendors claim 30% performance improvement on a retrofit

Cheapest To Deliver Optimization

- Examples, with as little math as possible!
- Numbers are engineered to illustrate situations not typically seen with 3 positions and 3 clients. The numbers are not intended to reflect typical costs, haircuts, etc.
- Choice of one month period is arbitrary and related to next section, collateral substitution
- For simplicity – delivering only one security per margin call

Security	Market Value	Cost (BPS)	Cost / $MM / month
A	$20MM	25	$208
B	$20MM	50	$417
C	$30MM	70	$583

Cheapest To Deliver Optimization

ISDA/CSA Eligible Collateral and Haircuts

Client	Security A Haircut	Security B Haircut	Security C Haircut
Alpha	25%	5%	45%
Beta	10%	25%	50%
Gamma	50%	10%	25%

Cost per $MM of collateral per month (post-haircut)

Client	A	B	C
Alpha	$278	$439	$1,061
Beta	231	556	1,167
Gamma	417	463	778

Cheapest To Deliver Optimization – Part I

Two Margin Calls. Cheapest To Deliver done one call at a time (Greedy Optimization: make best choice at each stage of the process)

Client Alpha: Call $15MM

Security	A	B	C
Quantity available	$20MM	$20MM	$30MM
Quantity required	$20MM	$15.8MM	$27.3MM
Cost/month	$4,167	$6,579	$15,909

Client Beta: Call $15MM

Security	A	B	C
Quantity available	$0	$20MM	$30MM
Quantity required	$16.7MM	$20MM	$30MM
Cost/month	n/a	$8,333	$17,500

Cost:

Alpha	$ 4,167
Beta	$ 8,333
Total	$12,500

Cheapest To Deliver Optimization – Part I

Same two margin calls. Simultaneous solution. Lowest cost across both calls

Security	A	B	C
Quantity available	$20MM	$20MM	$30MM
Alpha quantity required	$20MM	$15.8MM	$27.3MM
Alpha cost/month	$4,167	$6,579	$15,909
Beta quantity required	$16.7MM	$20MM	$30MM
Beta cost/Month	$3,472	$8,333	$17,500

Cost:

Alpha	$ 4,167
Beta	$ 8,333
Total	$10,051

$2,449 lower cost than prior example.

Cheapest To Deliver Optimization – Part I

Key points:

✓ Example illustrates the benefit of collateral optimization

✓ Batch is good! Change the operation to batch collateral decisions, and get better results

X Business and operational processes can hurt the optimization:

- Client Alpha is a valuable client. We commit to them by 7AM what collateral will be delivered
- Breaks client out of the batch and hurts optimization
- Can cost out (after the fact) this service. Maybe Alpha isn't that valuable a client.
- There are general techniques for reducing the cost of breaking the batch, but still has impact on optimization

Cheapest To Deliver Optimization – Part II

Commercial terms and client preferences: restrictions above and beyond contractual requirements on what collateral can be delivered

Client Alpha, is a good client, we won't deliver Security A to them, even though the Master Agreement allows for it

Here, the additional terms are recorded in Master Agreement system, so optimizer can take the terms into account

Security	A	B	C
Quantity available	$20MM	$20MM	$30MM
Alpha quantity required	$20MM	$15.8MM	$27.3MM
Alpha cost/month	$4,167	$6,579	$15,909
Beta quantity required	~~$16.7MM~~	$20MM	$30MM
Beta cost/Month	~~$3,472~~	$8,333	$17,500

Cost:

Alpha	$ 4,167
Beta	$ 8,333
Total	$12,500

X Cost of not delivering lowest cost collateral can be priced out, and is $2,449 per month in this example

Cheapest To Deliver Optimization – Part III

Here is a slight variation.

Additional terms are not recorded in Master Agreement system. Instead, they are recorded as unstructured data and not made available to the optimization software

Cheapest To Deliver Optimization – Part III

Unstructured data is not available to optimization software

Operations post-processes optimizer results by hand and has only expensive collateral to meet non-contractual requirements

Security	A	B	C
Quantity available	$20MM	$20MM	$30MM
Alpha quantity required	$20MM	$15.8MM	$27.3MM
Alpha cost/month	$4,167	$6,579	$15,909
Beta quantity required	~~$16.7MM~~	$20MM	$30MM
Beta cost/Month	~~$3,472~~	$8,333	$17,500

Cost:

Alpha	$ 6,579
Beta	$17,500
Total	$24,079

Or: $11,579 more than the cost from the prior example

X Overriding the collateral optimization results due to commercial terms or other reasons, can be costly

Collateral Substitution

- ✓ Market and inventory events change the relative value of collateral, and it is important to periodically take advantage of these changes
- ✓ There is a huge opportunity to fix sub-optimal choices made by cheapest to delivery optimization
- X Collateral substitution is rarely utilized to its fullest potential
  - Not driven by external events (margin calls, security lending transactions) to trigger the process
  - Costs are clear: operational manpower, settlement risk, *annoy* good clients. Benefits are not always measured
  - One business case *found* several $MM per year worth of valuable hard to borrow stocks being re-hypothecated by OTC/ISDA collateral group

    These stocks were pledged by other counterparties. Presumably re-hypothecating collateral pledged by yet other counterparties. Any one of the counterparties along the chain could have put these stocks to better use
  - Often exchange collateral (e.g., NYSE) is not considered for collateral substitution. Settlement risk is not an issue, and there is no client to annoy with frequent substitutions

Collateral Substitution

X Often poorly modelled

- Anecdotal stories of models recommending absurd number of substitutions
- Awkward constraints: no more than two substitutions per month per client. This is a good client, don't do any substitutions

✓ Linear optimization is extremely effective for substitution optimization

✓ Linear optimization works best when everything is modelled as a cost or benefit:

- Include the manpower and other costs of substitution, and number of substitutions will be reasonable
- Optionally include minimum savings for a movement. *Client is a good client, we would rather lose $10K per month than do a substitution*
- Can include all sorts of other constraints: minimum number of shares, only substitute in units of 100 shares, or settlement limits
- The more pools, the bigger the benefit. OTC, exchange, Repo, Stock Borrow Loan.
- Can include Regulatory Segregation optimization

Summary

- Change the optimization problem
- Avoid practices that hurt the optimization
- Adopt practices that help the optimization
- Choice of software still makes a difference
- Not just the optimization software, but also the Master Agreement systems, the inventory systems, …

Questions