

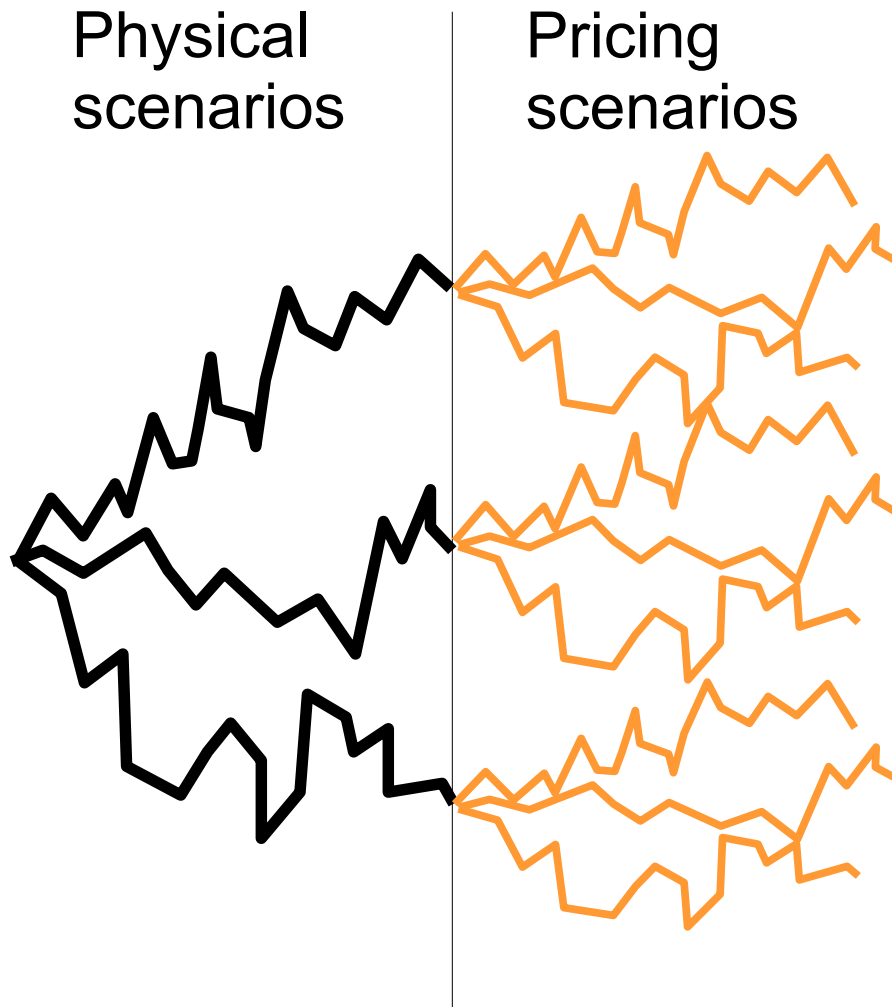
# Challenge



**THETARIS**  
Engineering in Finance

How to implement fast  
Monte-Carlo evaluations in  
potential future exposure  
evaluation.

# Problem



Product pricing with  
nested simulation  
is extremely  
time consuming

# Solution



**THETARIS**  
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Theta Proxy provides speed-ups  
between 100 and 100,000

as fast as PDE

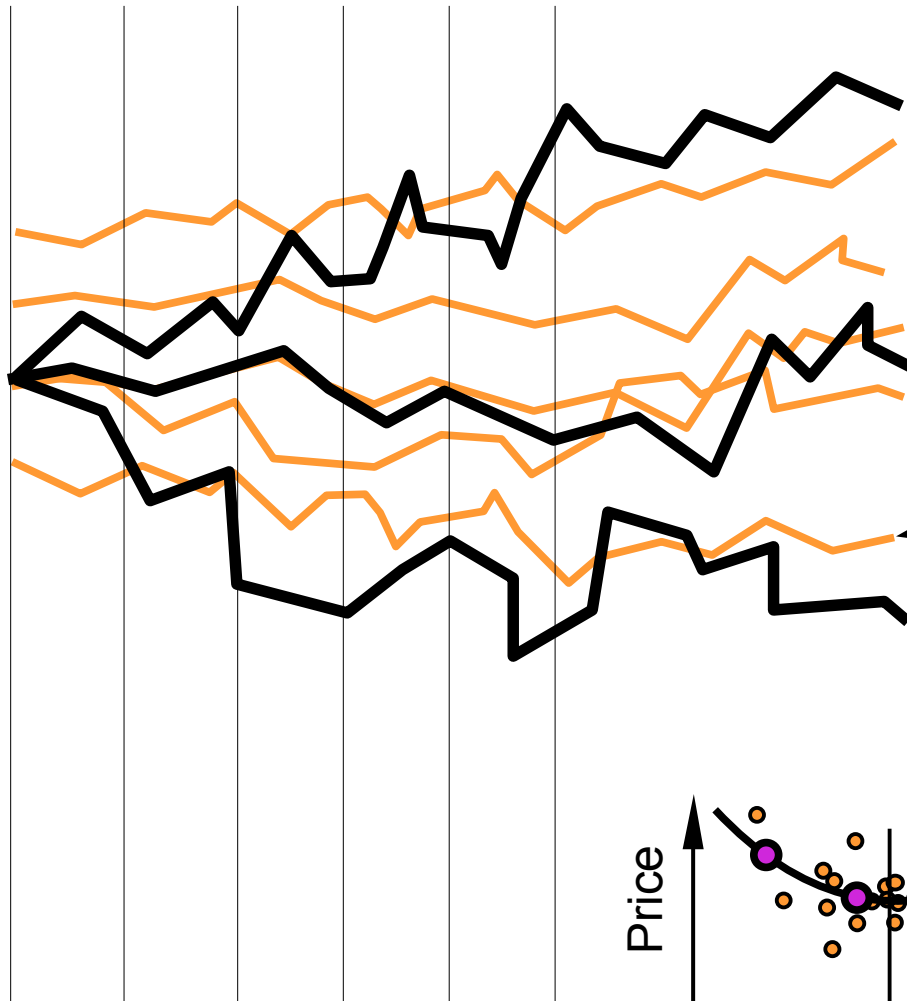
as universal as Monte-Carlo

# How does it work



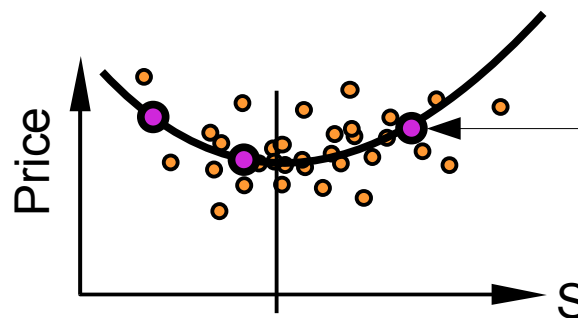
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The Theta Proxy obtains prices for all scenarios and all time steps with a single simulation.



Pricing paths

Physical scenario paths



Prices under physical scenarios are obtained by regression with optimized basis functions.

# How fast is it



Option type	analytic solution	nested MC (100 paths)	nested MC (10.000 paths)	PDE	<b>Theta Proxy</b>
European	0.6s	21s	34 min	5s	<b>7s</b>
American Asian	n.a.	n.a.	142 days(*)	200s	<b>80s</b>
Basket Barrier	n.a.	72 days(*)	1 year 98 days(*)	n.a.	<b>376s</b>

reported times for 1.25 mio evaluations measured on 1 Intel XEON 2,33MHz CPU  
(\* ) values are estimates based on the timing of single evaluations



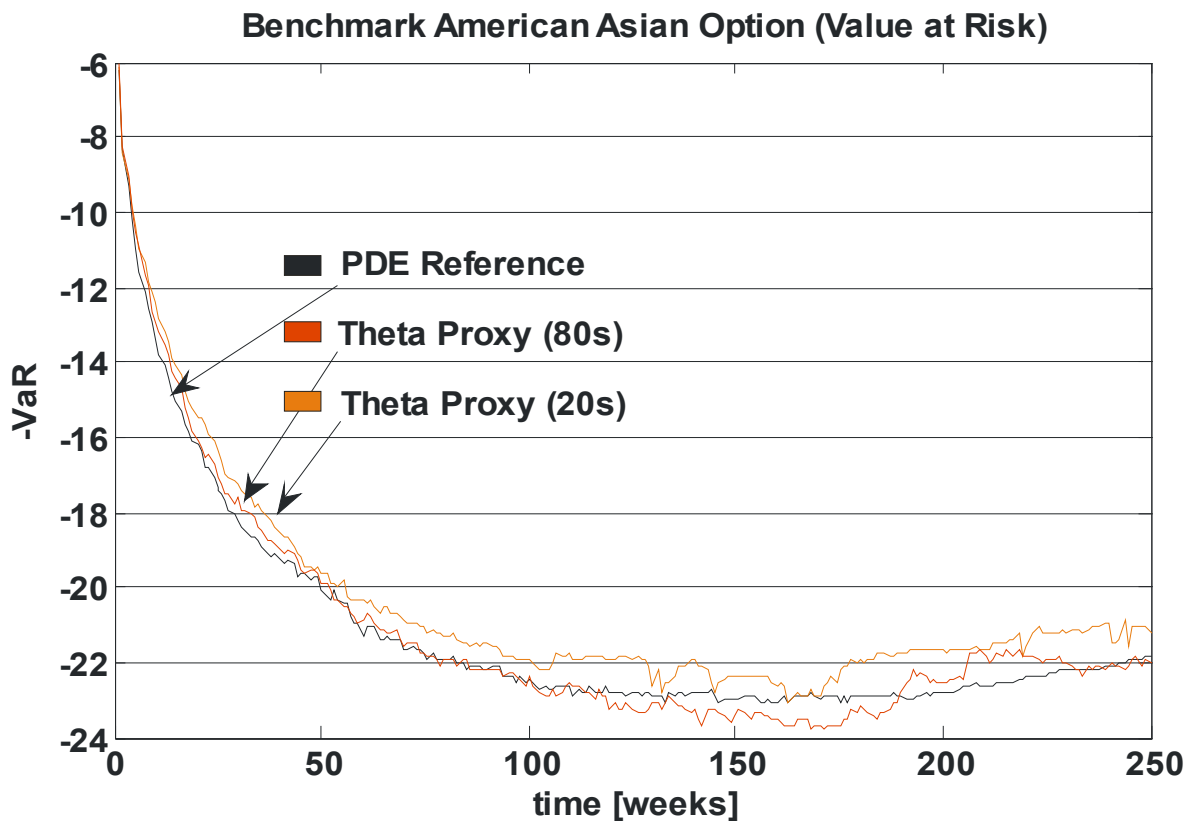
# How accurate is it

Theta Proxy uses an **optimized regression** algorithm for option pricing. The algorithm incorporates adaptivity, local cross validation and specially designed basis functions.

The MSE (mean squared error) in our examples is about **1000 times** smaller than a reference implementation with MARS (Multivariate Adaptive Regression Splines).



# Example: American Asian Option in 1.25 mio scenarios



*A benchmarking of Theta Proxy with an accurate PDE reference method ensures that the Theta Proxy is still applicable and the error of the risk measure Value at risk (VaR) is small. In the above figure, VaR is presented of the reference method as well as Theta Proxy with 20 and 80 seconds total CPU time.*