

MathWorks  
**FINANCE CONFERENCE 2023**

# Extending the Scope: From a Back Office Engine to a Growing Front Office Platform

October 11-12 | Online



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Asset  
Management

Alternative  
Investments

Asset  
Servicing

## Expanding the Scope: From Back Office Engine to Growing Front Office Platform

MathWorks FINANCE CONFERENCE 2023, 11. – 12. October 2023

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# Agenda

- |          |                        |    |
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| <b>1</b> | <b>Who we are</b>      | 3  |
| 2        | What we do             | 6  |
| 3        | Our use case           | 10 |
| 4        | Why Matlab?            | 17 |
| 5        | Expanding the scope... | 23 |

# Helaba Invest

## Successful in institutional asset management for more than 30 years



**# 1**  
**S-Finanzgruppe<sup>1</sup>**



**# 4**  
**in Germany**



**225.7**  
**bn EURO**

Total AuA

**100%**  
**subsidiary**

of Landesbank  
Hessen-Thüringen,  
founded in 1991

**402**  
**employees**

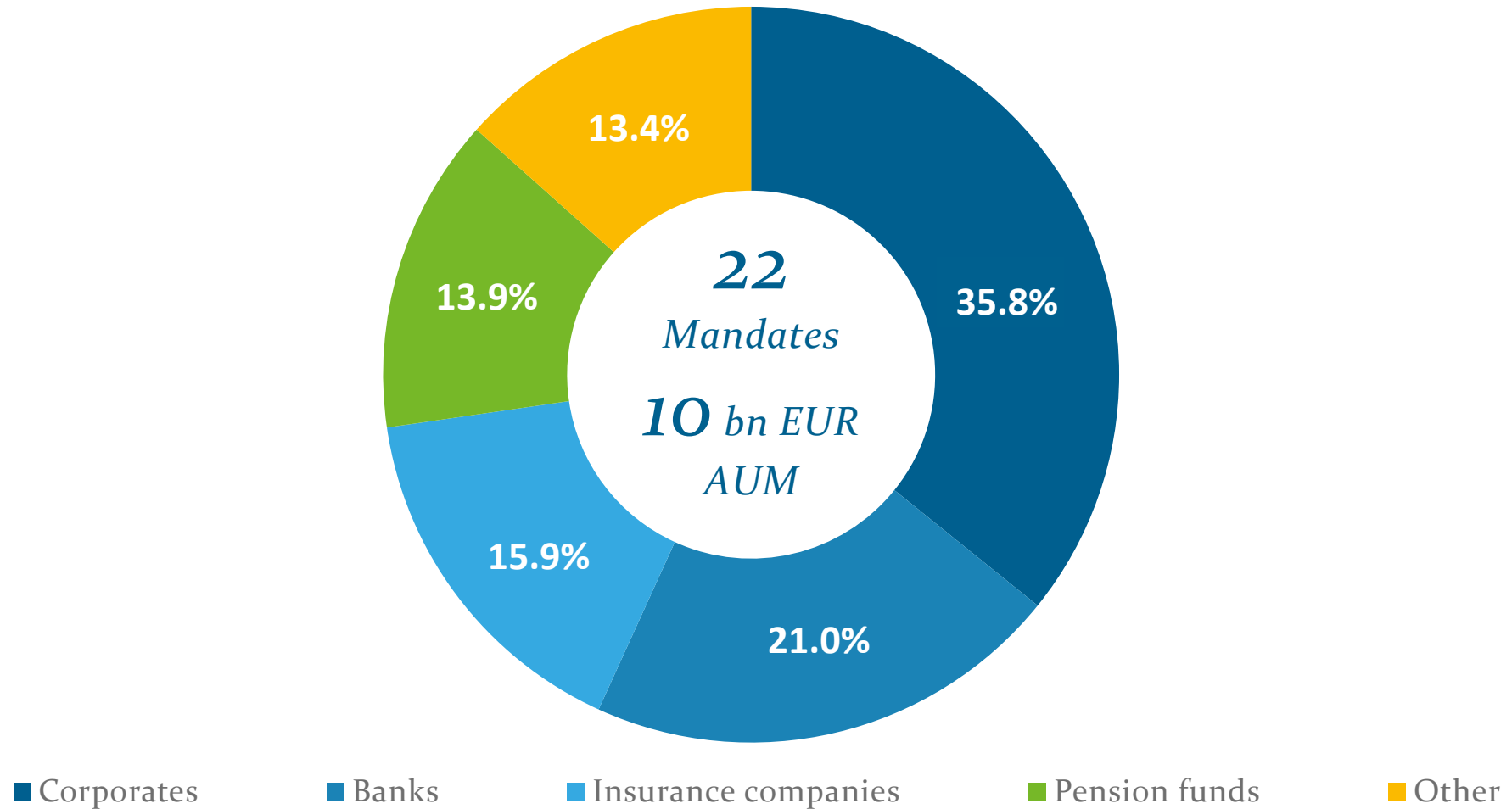
located in  
Frankfurt / a. M.

As of September 2023

<sup>1</sup> Source: BVI Investmentstatistik, Market positioning in terms of special fund volume within the S-Finance Group

Helaba Invest

## We are an established manager of overlay mandates for all client groups



As of September 2023  
Source: Helaba Invest, own calculations

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# Controlling the beta exposure

## Different types of risk can be hedged to varying degrees



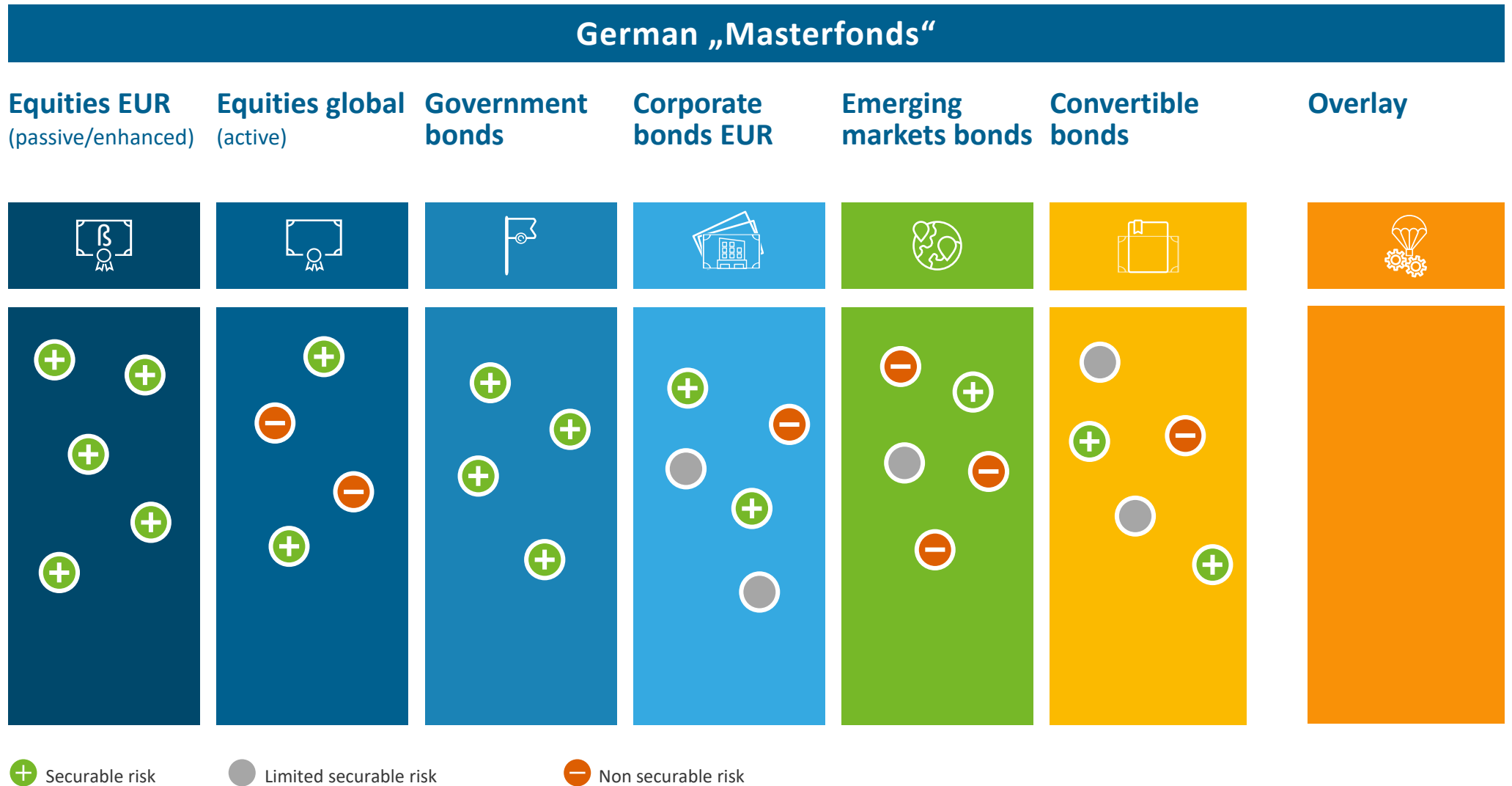
 Securable risk

 Limited securable risk

 Non securable risk

# The German „Masterfonds“ – aggregation of several segregate accounts

## A typical overlay structure...





# The German „Masterfonds“ – aggregation of several segregate accounts ... management of liquid risk factors within the overlay segment

## German „Masterfonds“

**Equities EUR**  
(passive/enhanced)

**Equities global**  
(active)

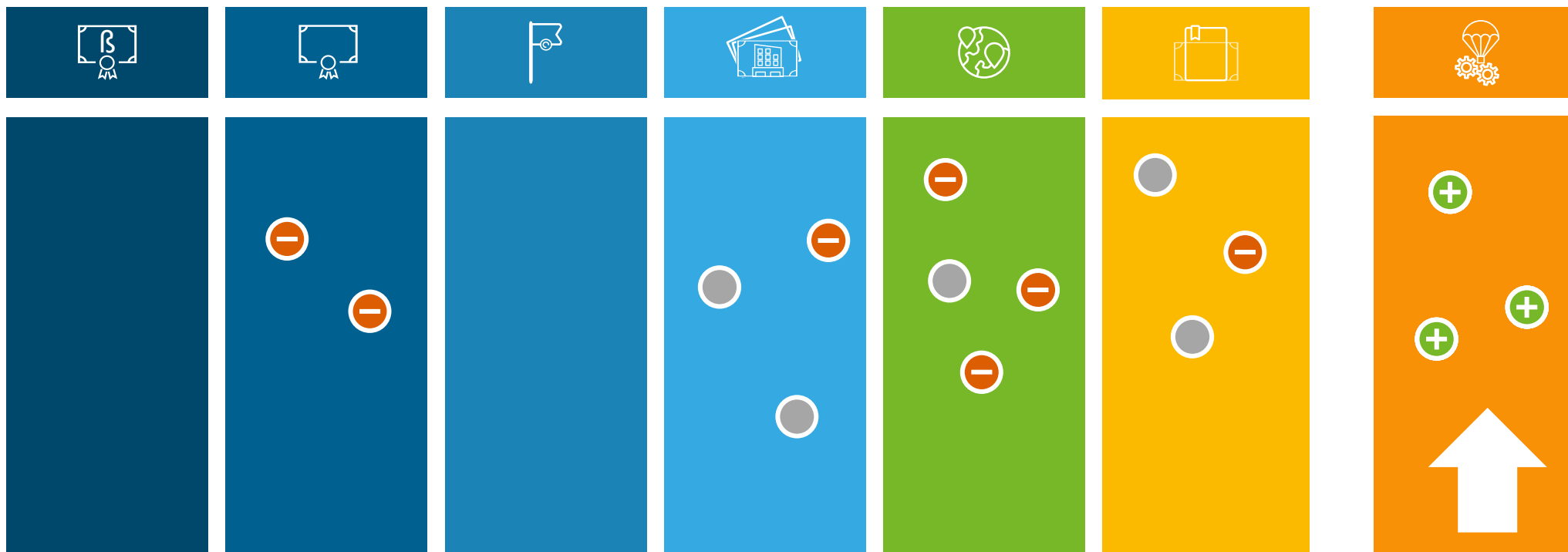
**Government bonds**

**Corporate bonds EUR**

**Emerging markets bonds**

**Convertible bonds**

**Overlay**



Securable risk

Limited securable risk

Non securable risk

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# Timeline

## Expanding the scope: from back office engine to growing front office platform

2008

### “The Greeks”

**Goal:** Compliance with regulatory requirements

2009

### Integration in reporting platform

**Goal:** Expanding the functional scope of customer reporting

2013

### Fixed income sensitivities

**Goal:** Expanding the functional scope of customer reporting

+  
Increase data quality

2016

### Present value calculation of OTC derivatives

**Cost reduction and scalability**

**Integration of MATLAB production server**

2021

### Front office platform

**Front office tool:**


- / Integration
- / Redis Cache
- / MATLAB report generator

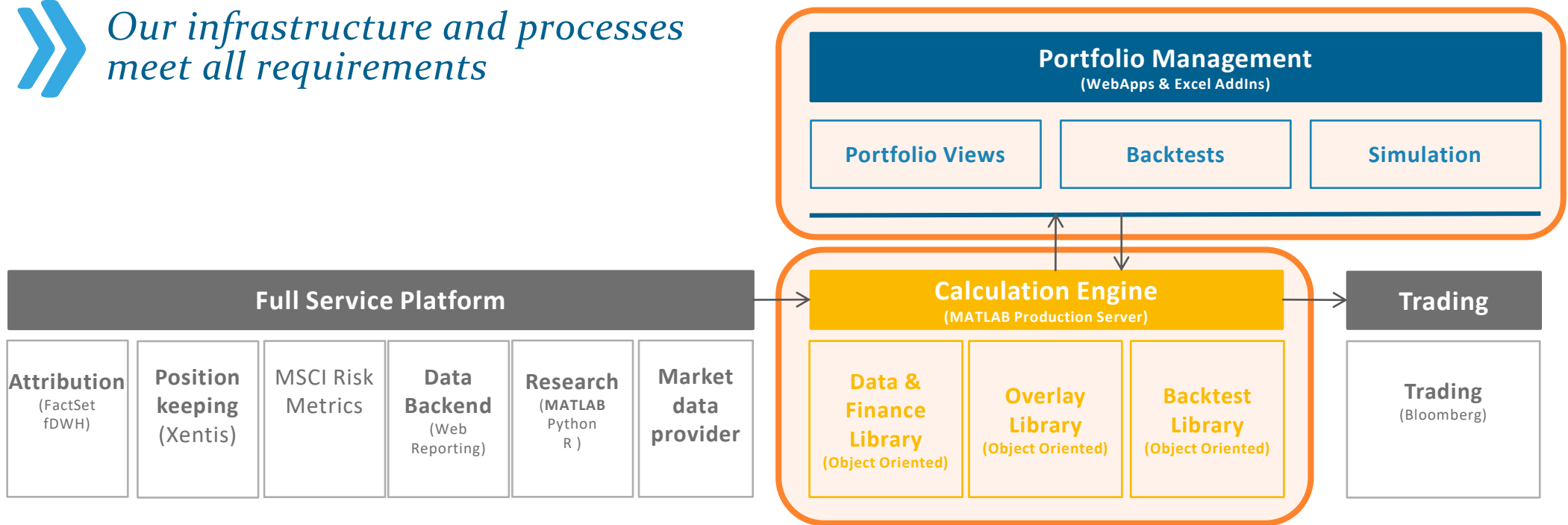
## Our use case

# Our modern infrastructure provides a solid basis

## Reasonable overlay management should meet a number of requirements

- / High quality and most current data
- / Clean execution and implementation
- / Solid portfolio management

 *Our infrastructure and processes meet all requirements*



\*currently in development

# Our use case

## Software and toolboxes in use

### MATLAB

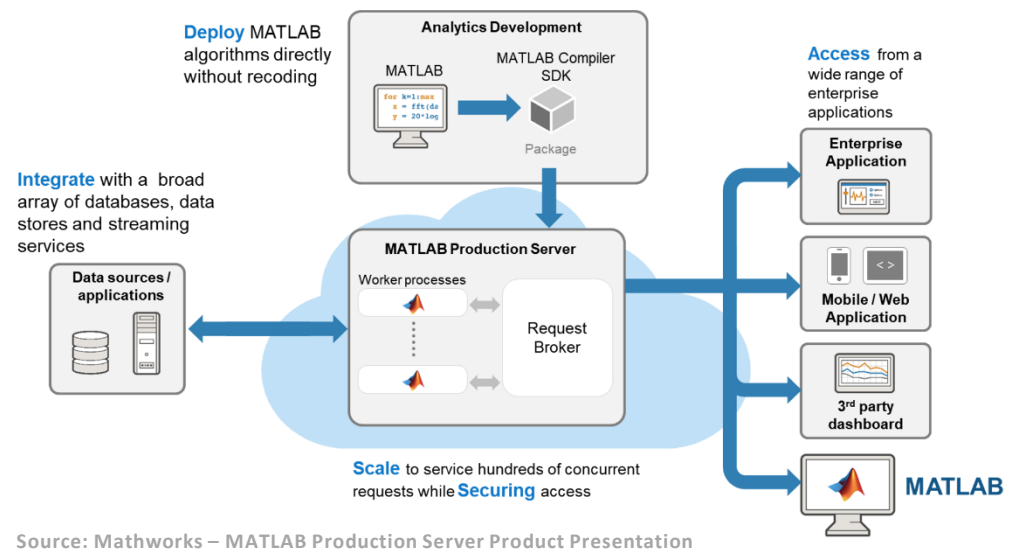
- / Parallel computing toolbox
- / Spreadsheet link
- / Statistics and machine learning toolbox
- / MATLAB report generator

### Toolboxes for computational finance

- / Database toolbox
- / Datafeed toolbox
- / Financial instruments toolbox
- / Financial toolbox
- / Optimization toolbox

### Toolboxes for application deployment

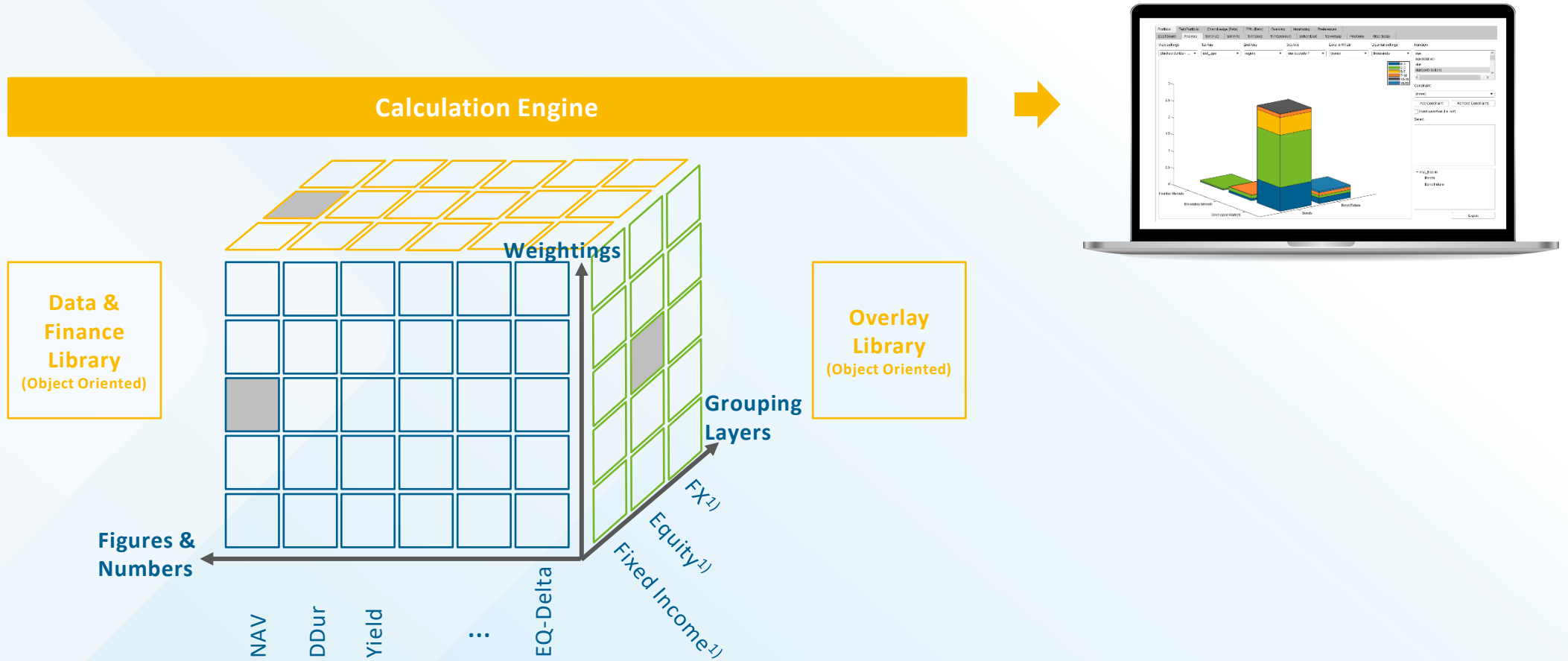
- / MATLAB compiler
- / MATLAB compiler SDK
- / MATLAB productions server
- / MATLAB WebApp server



Source: Mathworks – MATLAB Production Server Product Presentation

Our use case

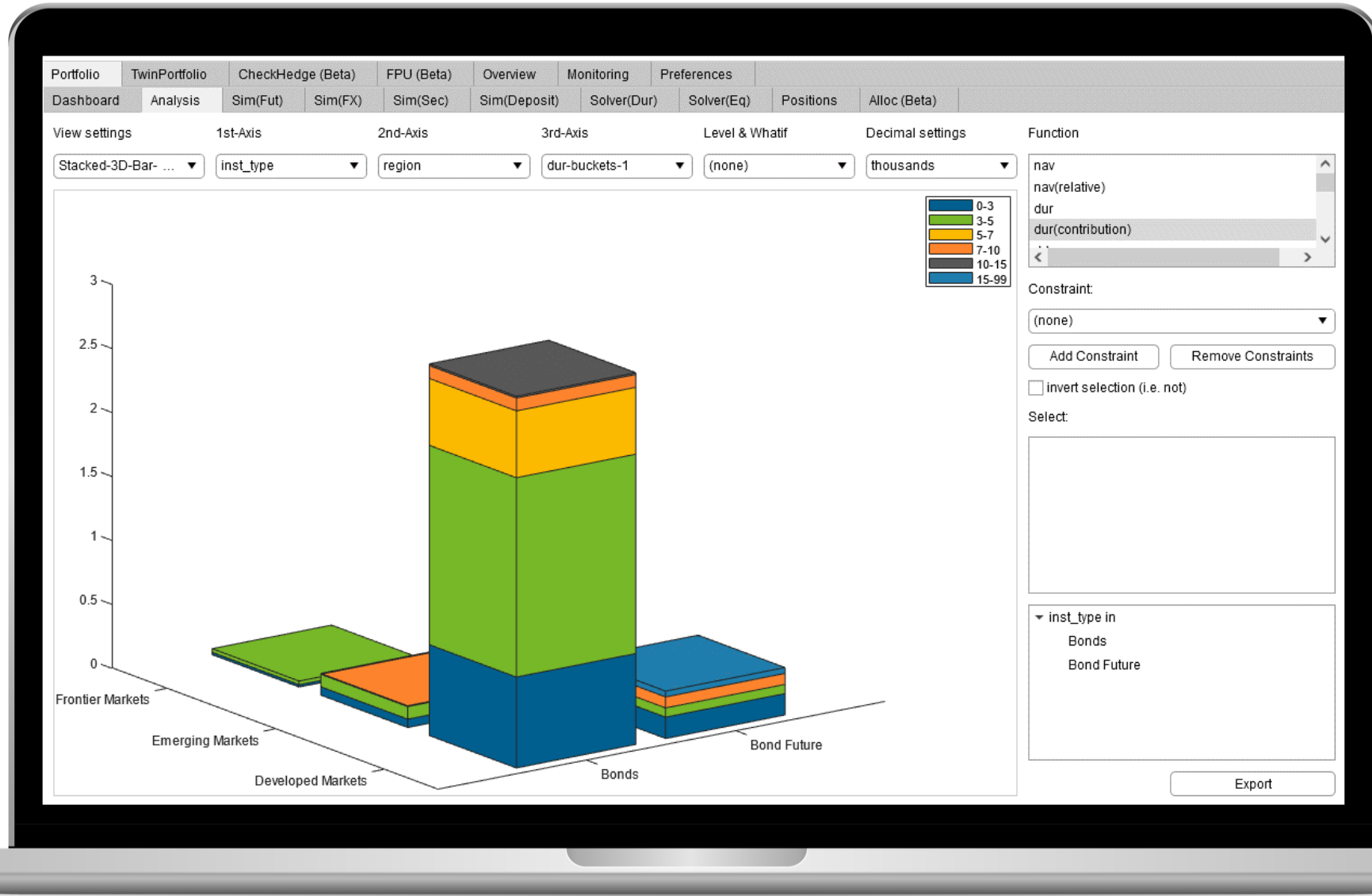
# Primary use case is data cube for portfolio analysis and simulation



<sup>1)</sup> Several Grouping Layers / Schemas, for Example Instrument Types, Country or Branch Schemas

## Our use case

# Primary use case is data cube for portfolio analysis and simulation



# Our use case

## Monitoring data processing on MATLAB

The screenshot displays a MATLAB monitoring interface with the following components:

- Navigation Bar:** Portfolio, TwinPortfolio, CheckHedge (Beta), FPU (Beta), Overview, Monitoring, Preferences.
- Refresh Button:** Refresh
- Log List:**
  - Xentis VA: LieferungID: 40335 @ 28.09.2023 11:17
  - VA: LieferungID: 40333 @ 28.09.2023 10:17
  - LieferungID: 40331 @ 28.09.2023 09:17
  - LieferungID: 40329 @ 28.09.2023 08:17
  - LieferungID: 40327 @ 28.09.2023 07:17
  - LieferungID: 40296 @ 27.09.2023 18:17
  - LieferungID: 40294 @ 27.09.2023 17:16
  - LieferungID: 40292 @ 27.09.2023 16:17
  - LieferungID: 40290 @ 27.09.2023 15:17
  - LieferungID: 40288 @ 27.09.2023 14:17
  - LieferungID: 40286 @ 27.09.2023 13:16
  - LieferungID: 40284 @ 27.09.2023 12:16
  - LieferungID: 40282 @ 27.09.2023 11:17
  - LieferungID: 40280 @ 27.09.2023 10:17
  - LieferungID: 40278 @ 27.09.2023 09:17
- Check Status:**
  - OverLayDataDir: ../../OverLayData/
  - Check valuation files...
  - Check fund cache...
  - Check complete!
- TSO Coverage Chart:** Bar chart showing the number of pricing data on a logarithmic scale (1.0 to 100,000.0) for various Data Providers across three dates: 27.09.2023 (blue), 26.09.2023 (orange), and 25.09.2023 (yellow).
- RKZ Coverage Chart:** Bar chart showing the number of pricing data on a logarithmic scale (1.0 to 100,000.0) for Data RKZ Lieferantenstufe (N.A., 450, 550, 600, 650, 700, 800, 1000, 1100, 1200, 2000) across three dates: 26.09.2023 (blue), 25.09.2023 (orange), and 22.09.2023 (yellow).
- Log Table:**

STEP_DT	PROCESS_NAME	MSG_TYPE	MSG_TEXT	STEP_LINE	POSITION	LOG_ID	AUFTRAG_ID
2023-09-28 11:42:41.960161	mps_load_overlay_fonds#202309281130007...	Close	connection	234	ProcessLibraries.closeDB	827912	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
2023-09-28 11:42:07.260938	mps_load_overlay_fonds#202309281130007...	mps_LOF	Starte virtuelle Fonds	114	mps_load_overlay_fonds	827911	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
2023-09-28 11:35:40.697007	mps_load_overlay_fonds#202309281130007...	mps_LOF	Starte Fonds mit Durchschau	95	mps_load_overlay_fonds	827910	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
2023-09-28 11:35:40.586882	mps_load_overlay_fonds#202309281130007...	mps_LOF	Starte Fonds ohne Durchschau	80	mps_load_overlay_fonds	827909	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
2023-09-28 11:35:40.475645	mps_load_overlay_fonds#202309281130007...	mps_LOF	Starte mfm_lib.fetch	72	mps_load_overlay_fonds	827908	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
2023-09-28 11:35:40.369728	mps_load_overlay_fonds#202309281130007...	mps_LOF	Starte Build Meta	61	mps_load_overlay_fonds	827907	MSA-MPSS/P-SRV-MATLAB01#28-Sep-2023 11:30:...
- System Status:**
  - State loading: ●
  - Bloomberg Connection: ●
  - Selection List: Show  Hide
- Footer:** Report a bug... Helaba Invest, Show Log, and a window icon.



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# Our proof of concept: accessing the cube via WebApp and Excel

## Solution for Excel: wrapping the overlay fund object

After fund object is created by MATLAB Production Server (MPS), you can...

...access the cube through MATLAB (i.e. WebApp)

- / Fund object is imported from MPS
- / Fund object initializes data cube
  
- / Data cube is accessed via fund query functions

...access the cube through Excel

- / Fund object is imported from MPS
- / Fund object initializes data cube
- / Unique ID is provided to access cube
  
- / Fund object is selected by unique ID
- / Data cube is accessed via fund query functions

```
% Fund object "F" ist loaded via mps
%
% function out_msg = mfmInit(obj, p_Segments, p_Meta)
F.mfmInit([], table.empty);
```

```
% function out = mfmQuery(obj, p_Fun, varargin)
F.mfmQuery('dur', 'rating(hi)', 'AA+', 'fx', 'CAD')

ans = 7.8980
```

=fm\_load(604;"";"mps(cache)";0)

F	G	H
unique id	3798458	

=fm(G2;"dur";"rating(hi)";"AA+";"fx";"CAD")

K	L	M	N
query	7,897977		

same syntax

same results

# Our proof of concept: accessing the cube via WebApp and Excel

## Quick slice and dice via Excel using MATLAB methods

### What you see in the WebApp...

- / In the WebApp the data cube is accessed directly via the overlay fund object
- / We built an inspection function to show how information is obtained via Excel

The screenshot shows a WebApp interface with a table of data. The table has columns for currency (AUD, CAD, CHF, DKK, EUR, GBP, HKD) and rows for rating (N.R., AAA, AA+, AA, AA-, A+, A, A-, BBB+, BBB, BBB-). The value '7.90' is highlighted in the cell for rating 'AA+' and currency 'CAD'. An 'Info' dialog box is overlaid on this cell, displaying the formula: `7.90 = fm(fm_id; "dur"; "rating(hi)"; "AA+"; "fx"; "CAD")`.

### ...is what you get in Excel

- / Once that data cube is imported, MATLAB methods can easily be used to quickly run slice and dice analysis
- / Only a few lines of VBA Code remain as wrapper to access the MATLAB DLL

The screenshot shows an Excel spreadsheet with the same data cube table as the WebApp. The formula bar at the top displays the formula: `=fm($G$5;"dur";"rating(hi)";$F9;"fx";H$6)`. The value '7.90' is highlighted in the cell for rating 'AA+' and currency 'CAD'.

# Our proof of concept: accessing the cube via WebApp and Excel

## It's the speed, stupid!

### How fast can it be in Excel?

/ Setting up the environment

/ Starting Excel

/ Loading MATLAB runtime & complied DLL

→ *normally < 1 minute once a day*

/ Loading the fund object

/ Accessing the MPS & creating cube

→ *approx. 2 – 5 seconds*

/ Using the query function in Excel

/ Excel to VBA to Matlab DLL and vice versa

/ plus the actual query (< 1 millisecond)

→ *approx. 2 milliseconds for each query*

```
tic
fm_id = fm_load(604, [], 'mps(cache)', 0);
toc
```

Elapsed time is 2.299943 seconds.

```
tic
for i = 1 : 10000
    res = fm(fm_id, 'dur', 'rating(hi)', ...
            'AA+', 'fx', 'CAD');
end
toc
```

Elapsed time is 2.575534 seconds.

That's fast enough for us 😊

# Our proof of concept: accessing the cube via WebApp and Excel

## Technical fun fact: trying to gain more speed via C failed

### Idea: gain even more speed

- / Cube slice and dice via query uses ismember
- / Cube with look-through of mutual funds often exceeds 1,000 positions
- / ismember → & ismember → & ismember → ... should easily be beaten in speed!
- / How? Write your own selection function that uses „Loc“ instead of „Lia“ with the help of the memory stack via „calloc“

### Surprisingly, we failed!

- / Wrong C Compiler options?
- / Optimizing the for loops?
- / Usage of assembler?
- / What else?

```
mfm_selection.c x +
1  /*-----*/
2  /*-----*/
3
4
5  #include <stdio.h>
6  #include <string.h> /* strlen */
7  #include "mex.h"
8
9  void
10 compare_double(mxUint64 *res, long *n_match, mxUint64 *sel,
11               void *adata, void *ldata, long n, long n_l)
12 {
13     long i, j;
14     mxDouble *a, *l;
15     mxDouble *a_e, *l_e;
16
17     mxUint64 *p;
18
19     p = res;
20
21     a = (mxDouble *) adata;
22     l = (mxDouble *) ldata;
23
24     a_e = (mxDouble *) adata + n;
25     l_e = (mxDouble *) ldata + n_l;
26
27     *n_match = 0;
28
29     if (sel)
30     {
31         for (i = 0; i < n; i++)
32         {
33             for (j = 0; j < n_l; j++)
34             {
35                 if (a[sel[i] - 1] == l[j])
```

## Our proof of concept: accessing the cube via WebApp and Excel

### Summary: MATLAB made it easy for us

	<b>MATLAB</b>	<b>Python</b>	<b>R</b>	<b>VBA</b>	<b>C/C++</b>	<b>C#</b>	<b>Java</b>
<i>Server</i>	✓				✓	✓	✓
<i>Integration of existing platform</i>	✓	(✓)	(✓)		(✓)	(✓)	(✓)
<i>WebApp Framework</i>	✓	✓	✓				✓
<i>Excel via compiled DLL</i>	✓				?	✓	
<i>Easy to use</i>	✓	✓	✓	✓			✓
<i>„Matrix“ handling</i>	✓	✓	✓		✓	✓	✓
<i>Avoids VBA completely</i>						✓	
<i>Speed</i>	✓	(✓)	(✓)		✓	✓	

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| <b>5</b> | <b>Expanding the scope...</b> | <b>23</b> |

Extending the scope... even further

## Beyond the overlay fund object on the path of least resistance...

	WebApp	Excel	Server
<i>Portfolio simulation</i>	✓	✓	
<i>Market monitoring</i>	✓		
<i>Overlay back testing framework</i>		✓	✓
<i>Portfolio optimizer</i>	✓		
<i>Multi asset categories</i>	✓	✓	✓
<i>Multi asset model portfolios</i>	✓	✓	✓
<i>DWH via Redis Cache</i>			✓
<i>ALM-light (normal distribution)</i>		✓	
<i>ALM (non-normal distributions)</i>		announced	
<i>Attribution</i>		ideas	



## Contact

**Don't hesitate to contact us ...**

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