Risk Management Service in Financial Industry

Integrated reporting solutions and managed services for Risk

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Agenda

1. **Risk Management Service at KPMG**
2. **Zoom on Risk Reporting Services: Challenges & Requirements**
3. **Micro-Service Architecture. MATLAB as a Calculation Engine.**
4. **Practical Example: Real Estate Application**

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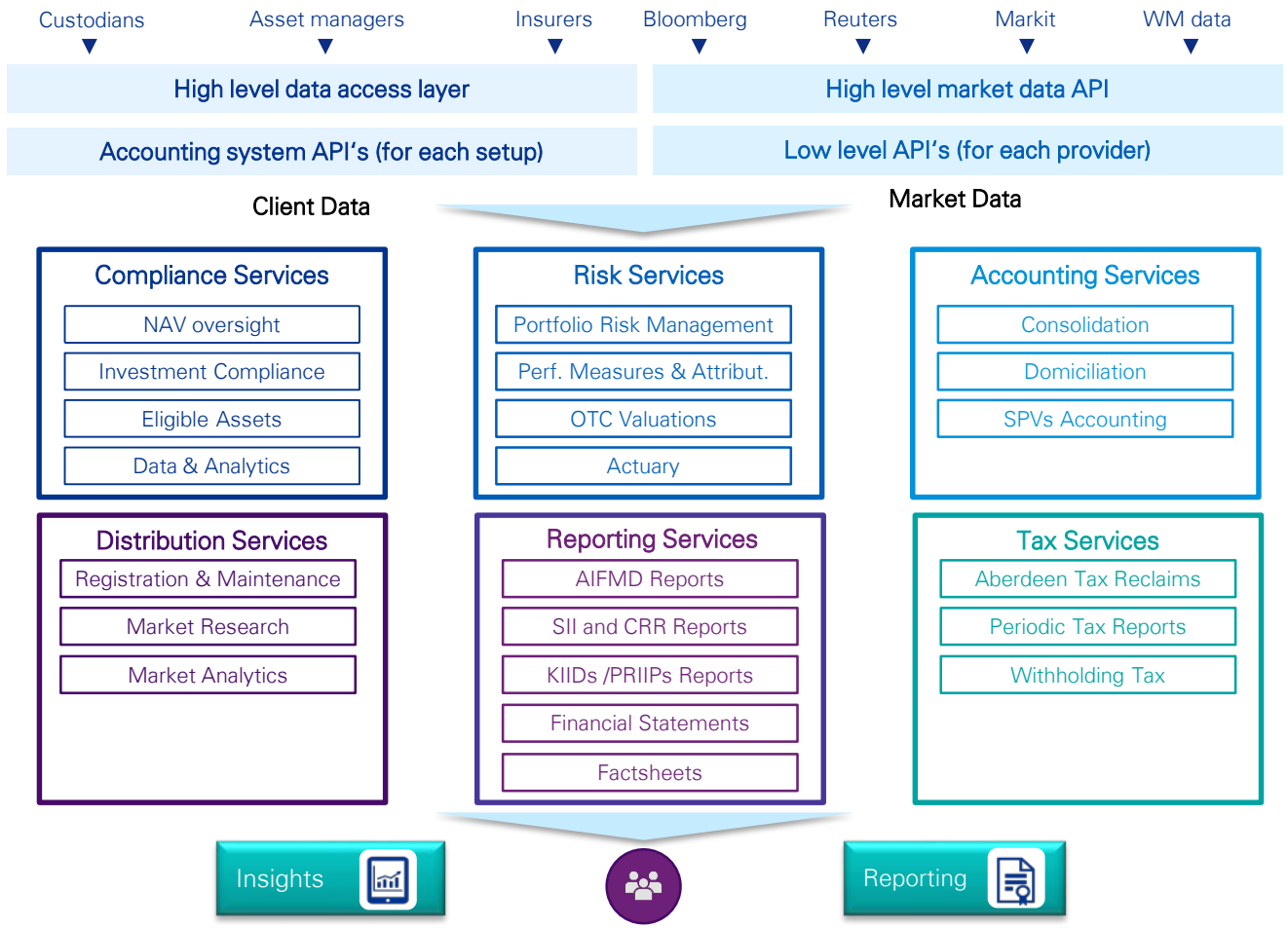
Risk Management Service at KPMG

KPMG Service Platform

Our in house platform relies on a solid multi-layered integration technology framework



- ✓ **Over 100 clients worldwide**
- ✓ **Clients in more than 50 countries**

- ✓ **More than 150 professionals**
- ✓ **Dedicated team in Luxembourg**

- ✓ **Complete range of services**
- ✓ **150 000 reports produced p.a.**

- ✓ **Online workflow management tool**
- ✓ **Tailored managed services**

- ✓ **Regulatory Knowhow & Support**
- ✓ **KPMG CoE for IM in Luxembourg**

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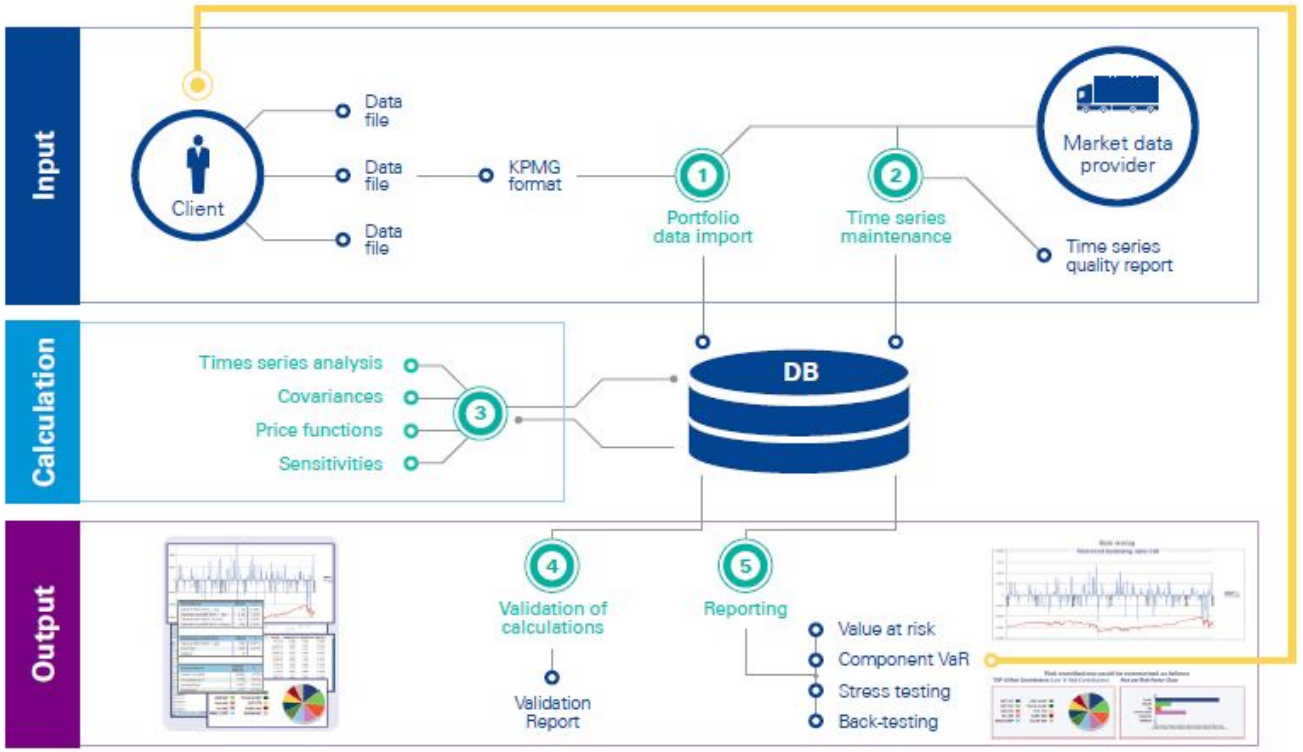
Risk Reporting Services

Focus on the Market Risk Engine

RACER for Risk, AIFMD, Solvency II, Liquidity, SRI / SRRI, 4C, Investment Compliance, CRR, GroMikV, VAG, COVIP, PRIIP

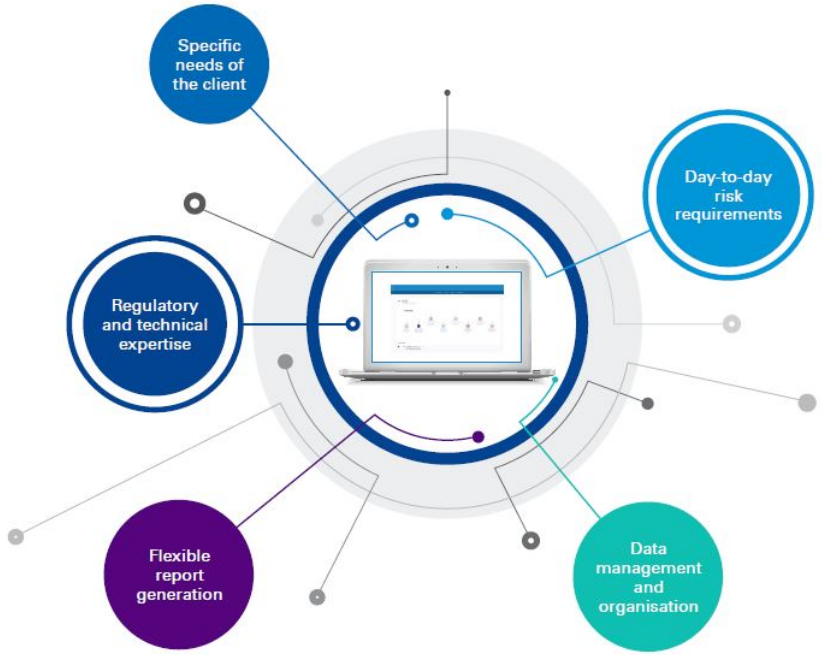


RACER Platform – Key Benefits

- ✓ **One central service platform that enables reporting based on client needs**
- ✓ **Central source of reference data in a standard format / normalized for different service platforms and service providers**
- ✓ **Regulatory expertise and standardized data that enables quick turnaround on regulatory changes**
- ✓ **Easy access to other tools and functions**
- ✓ **Benefit from common development**
- ✓ **Synergy creation through use of client specific selection of several Racer services**

Risk RACER

"KPMG Racer is designed to provide tailor-made solutions to address portfolio managers' needs as well as comply with regulatory requirements"



KPMG RACER

- In-house developed solution designed to calculate various risk measures
- Used in operational process since 2011
- The core functionality for Market & Credit Risk is implemented in MATLAB
- Agenda snapshot
  - ✓ Daily calculation of VaR and Conditional Value-at-Risk (CVaR), Marginal, Incremental and Component VaR (risk contribution) for all assets within the portfolio
  - ✓ Weekly/monthly automated SRRI calculation (UCITS KID) / SRI calculation (PRIIPs KID) with a sound methodology validated by KPMG's experts covering all fund categories
  - ✓ Yearly/monthly automated past performance / performance scenarios
  - ✓ Calculation of stress scenarios, portfolio's volatility
  - ✓ Identification of main risk drivers within a portfolio (positions with major risk contribution)
  - ✓ Clean and dirty back testing, Sensitivity Analysis
  - ✓ Ability to treat various input files (e.g. additional collateral portfolios provided by client …)

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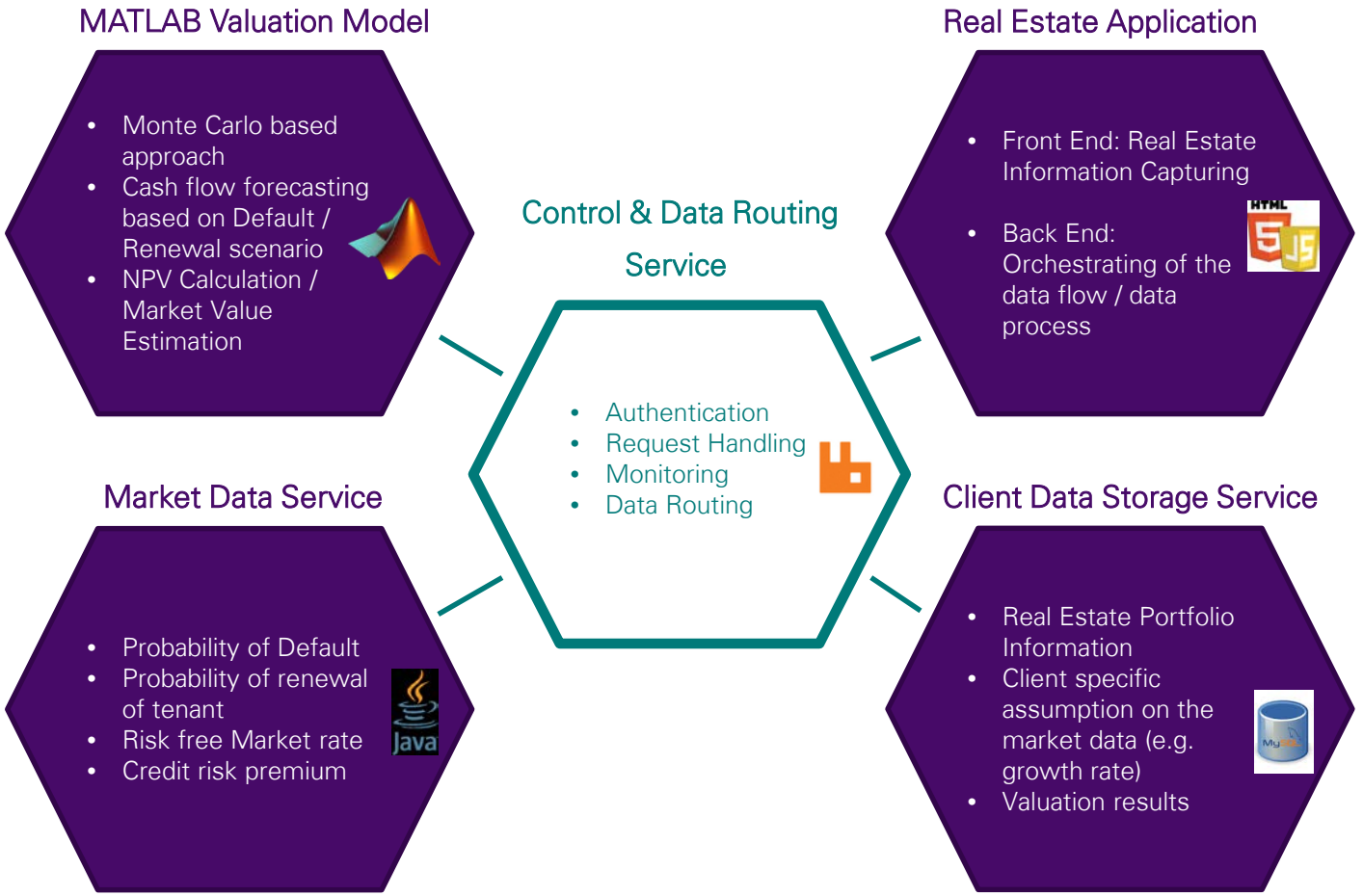
Micro Service Architecture: MATLAB as a Calculation Engine

Micro Services Architecture Approach



Why MATLAB?

Why MATLAB

- ❑ Young Quant Team: MATLAB experience directly from the University. Not necessarily knowledgeable on low level programming language.
- ❑ Broad spectrum on the available toolboxes: Statistics, Financial, Optimization toolboxes provide many of algorithms mostly used in finance
- ❑ Short implementation time for the new requirements: same algorithm can be written in less number of lines compared to other programming languages

Advantages/Disadvantages

- ❑ Pros:
  - \+ Code reliability: extensively tested before release.
  - \+ Documentation: wide documentation and examples.
  - \+ Support: professional and dedicated support team
- ❑ Cons:
  - \- License Costs

Looking ahead

- ❑ KPMG develops solutions in the Micro Service Architecture independent of the technology and operational system (Web-Services based)
- ❑ MATLAB production server (MPS) & MATLAB 2016 Release (JSON) support the current strategy requirements

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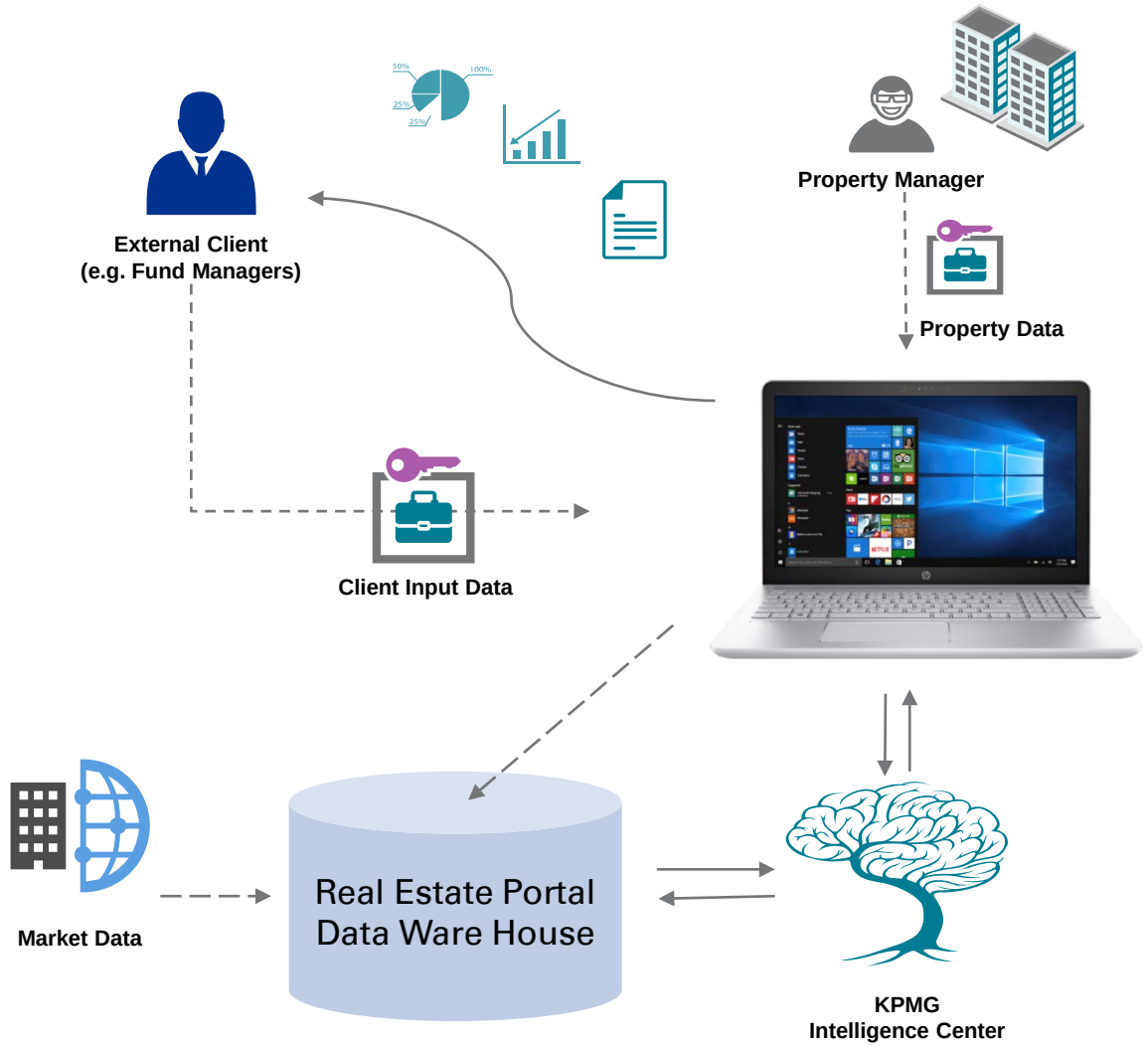
Practical Example: Real Estate Application

Real Estate Application



Market Analysis

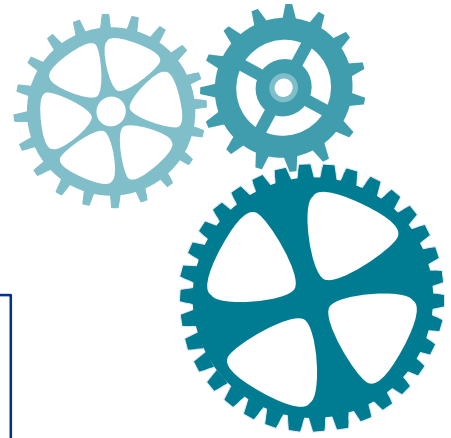
Valuation

Risk Measurement

Reporting

D&A

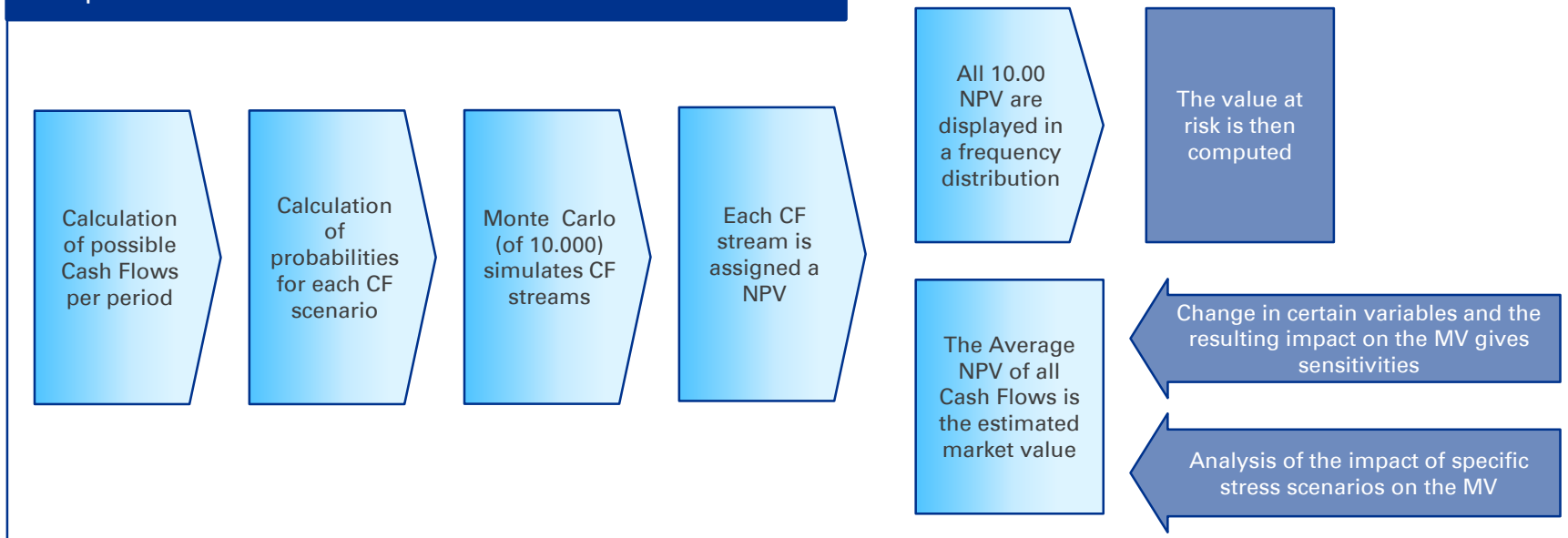
Introduction to RE model



What does the model offer?

- Replicate professional valuation & estimate a market value within a reasonable range
- Implement more realistic assumptions for future Cash Flow developments
- Assessment of the value at risk, sensitivity analysis and individual stress tests

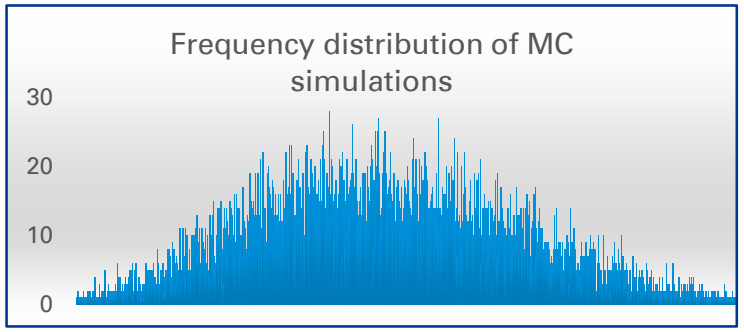
Setup of the model



Risk analysis at Portfolio - level

- Procedure is applied to each object individually
- Tool aggregates Cash Flow simulations of all objects per simulation and period
- Finally: a NPV on portfolio – level for each MC simulation is computed

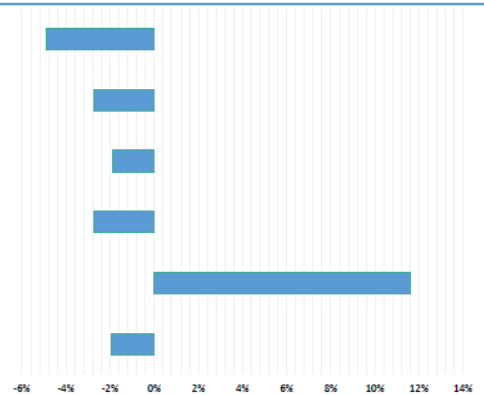
All 10.000 NPVs are displayed in a frequency distribution



The average NPV of all Cash Flows is the estimated market value:

The value at risk and Cash Flow at risk is then computed

Input variable	Change	Absolute impact on MV
Vacancy rate	+1%	- 608 115.10 €
Default risk of tenants	+1%	- 340 529.14 €
Renewal rate	from 0.9 to 0.8	- 235 684.72 €
Risk Premium	+1%	- 336 094.57 €
Growth of rents	+1%	1 435 375.02 €
Growth in maintenance costs	+1%	- 240 277.44 €



Change in certain variables and the resulting impact on the MV gives sensitivities

Analysis of the impact of specific stress scenarios on the MV

Real Estate Application - Demo

vs.

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Thank you

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