

Embrace Complexity Across Financial Institutions

Yi Wang
Manager, Application Engineering
MathWorks



The Impossible Becomes Possible

FINANCIAL CRISIS OF 2008





BREXIT

EU







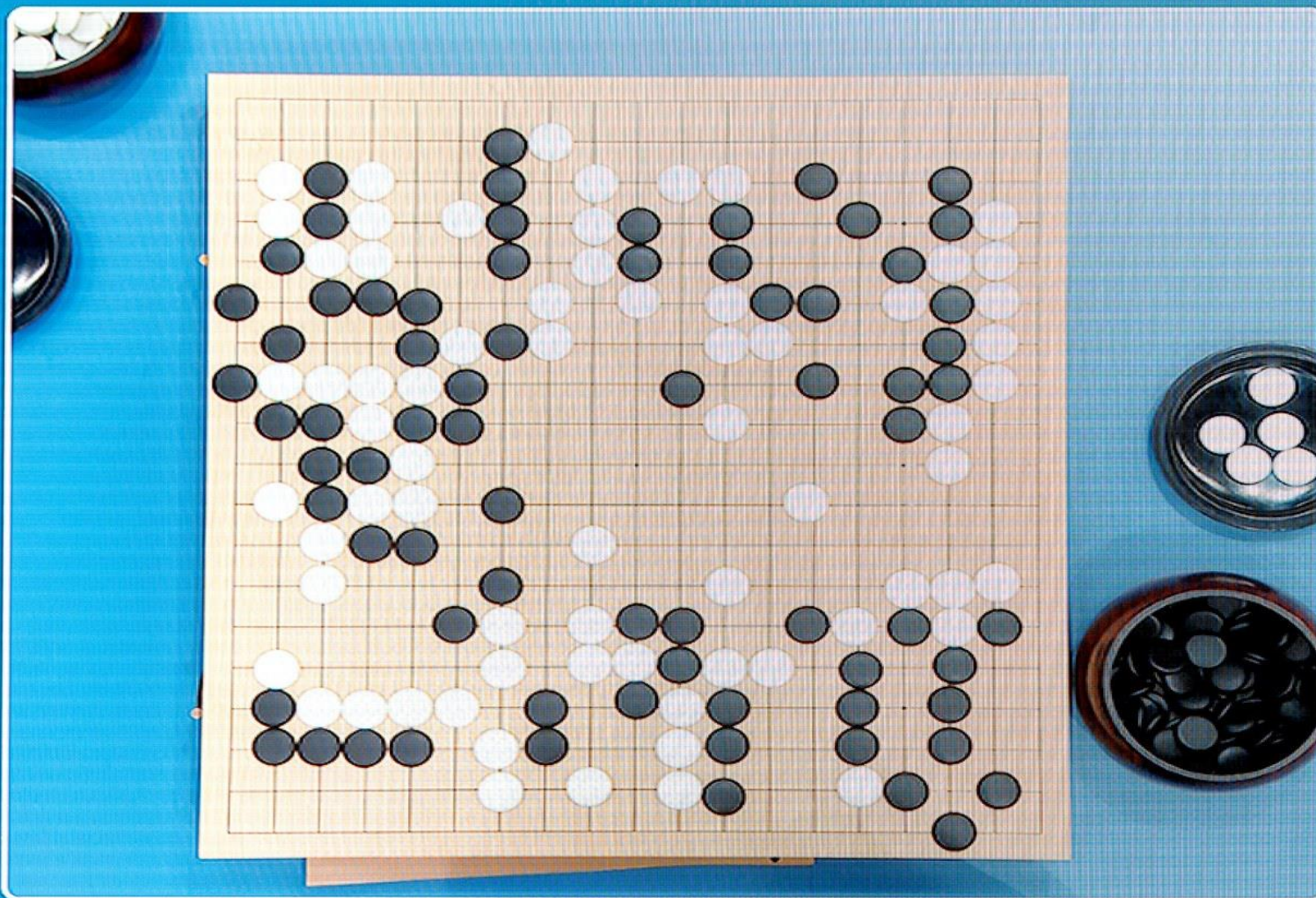




by Kiril Krastev



Technology Disruptions



柯洁 KE JIE

00:50:24



ALPHAGO

02:11:49



World's Largest Taxi Company...
Owens No Vehicles



U B E R

World's Largest Retailer...

Carries No Inventory



Alibaba.com

阿里巴巴



World's Largest Media Company...

Creates No Content

facebook.



Oil & Gas

Modern facilities have more than **80,000** sensors in place, and a single reservoir will produce more than **15 PB** of data in its lifetime



Public Safety

New York City surveillance cameras and sensors generate **520 TB** of data per day, largely unstructured



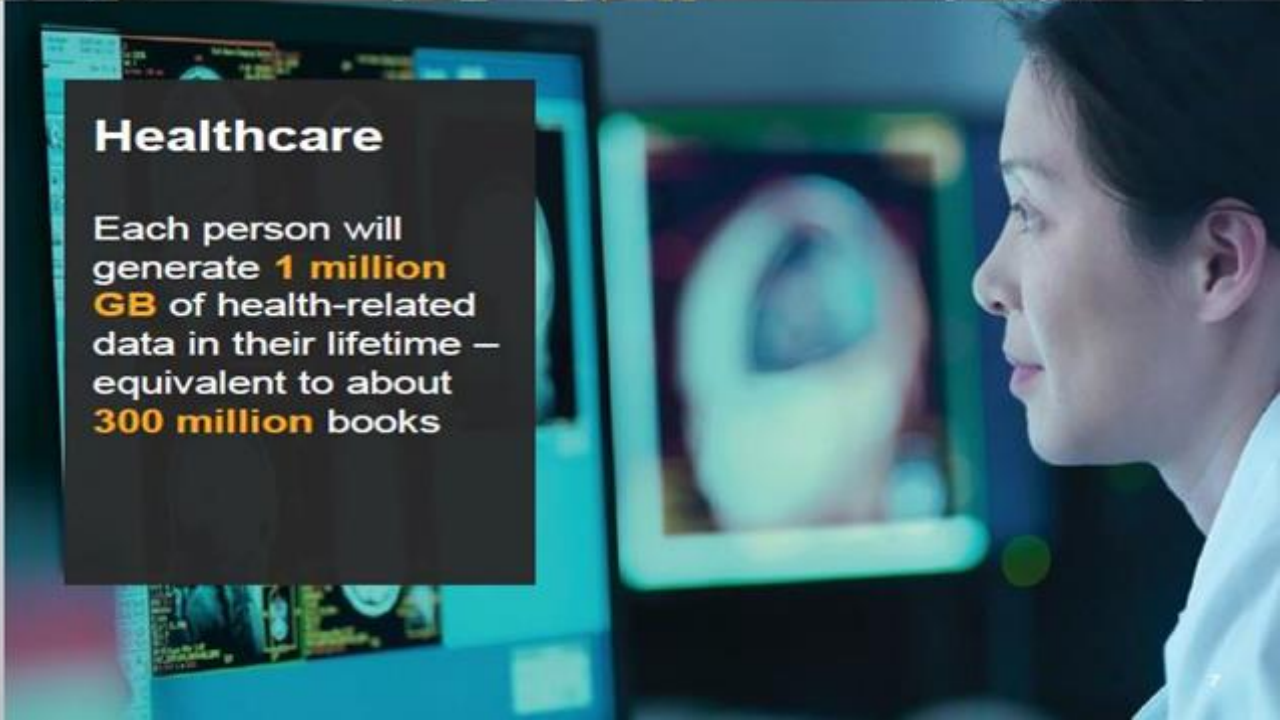
Energy & Utilities

More than **680 million** smart meters will be installed globally by 2017 – producing more than **280 PB** of new data to be analyzed and acted upon



Healthcare

Each person will generate **1 million GB** of health-related data in their lifetime – equivalent to about **300 million** books



Analytics: The Upside of Disruption

Insights from the IBM Global C-suite Study

Three Disrupters

- 1 Accelerated digitization
- 2 Radical technology changes
- 3 Knowledge replacing speculation

The Technology is advancing rapidly and is ready...

Machine Learning



IoT/Sensors



**Simulation/
Gaming**



Advanced Visualization

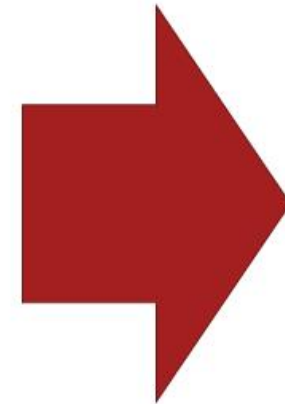


Man

+



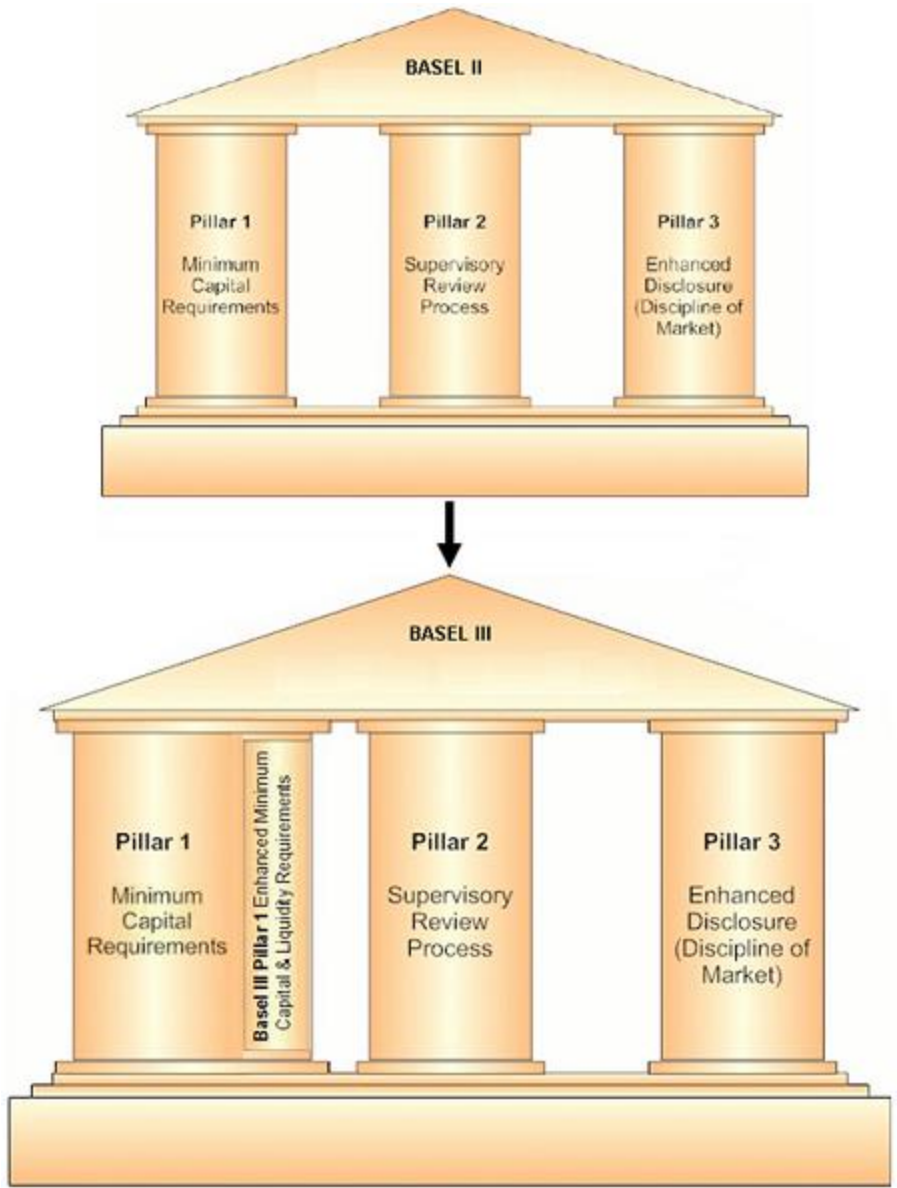
Machine



New Value

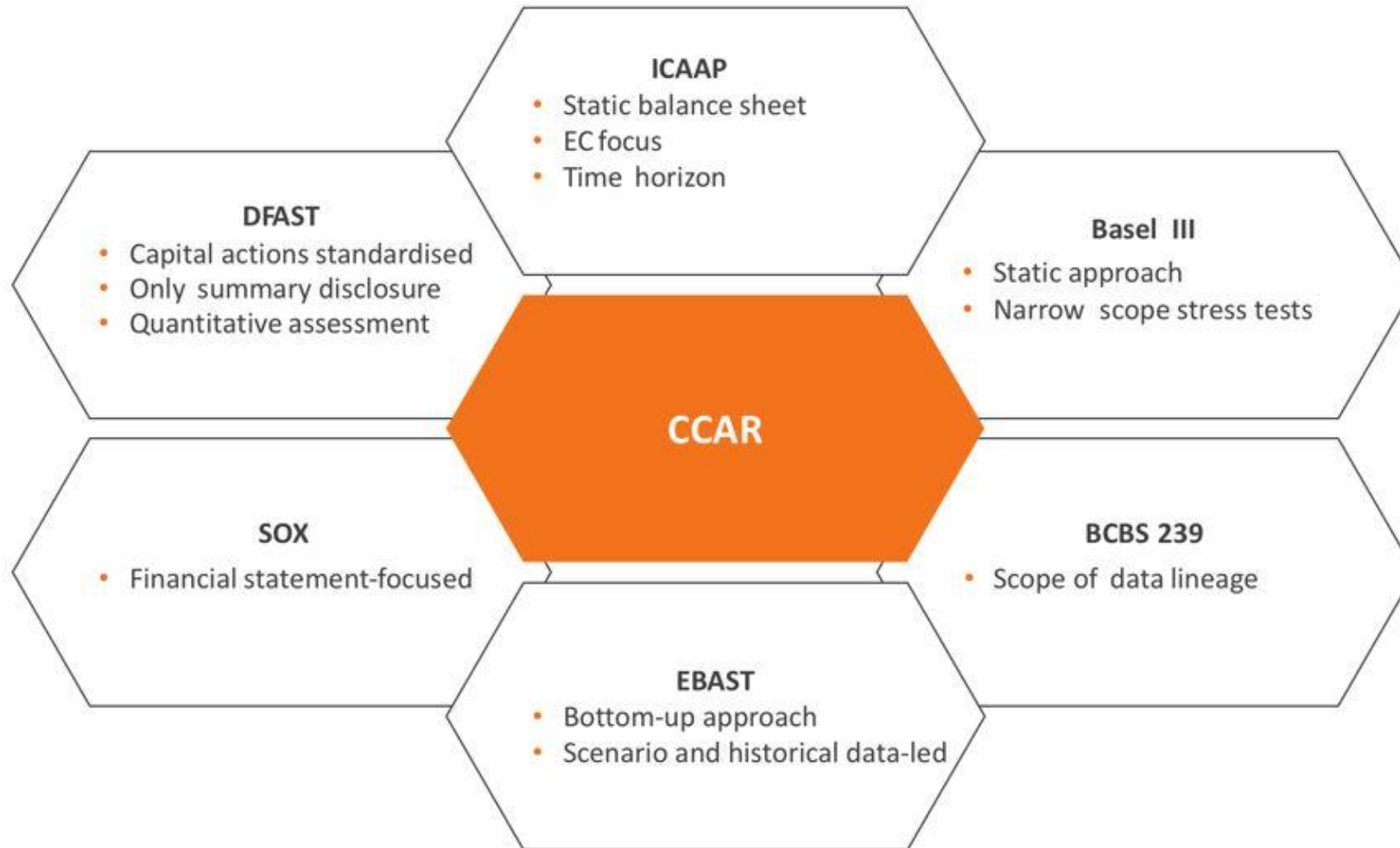
When will you be ready?

More Regulations

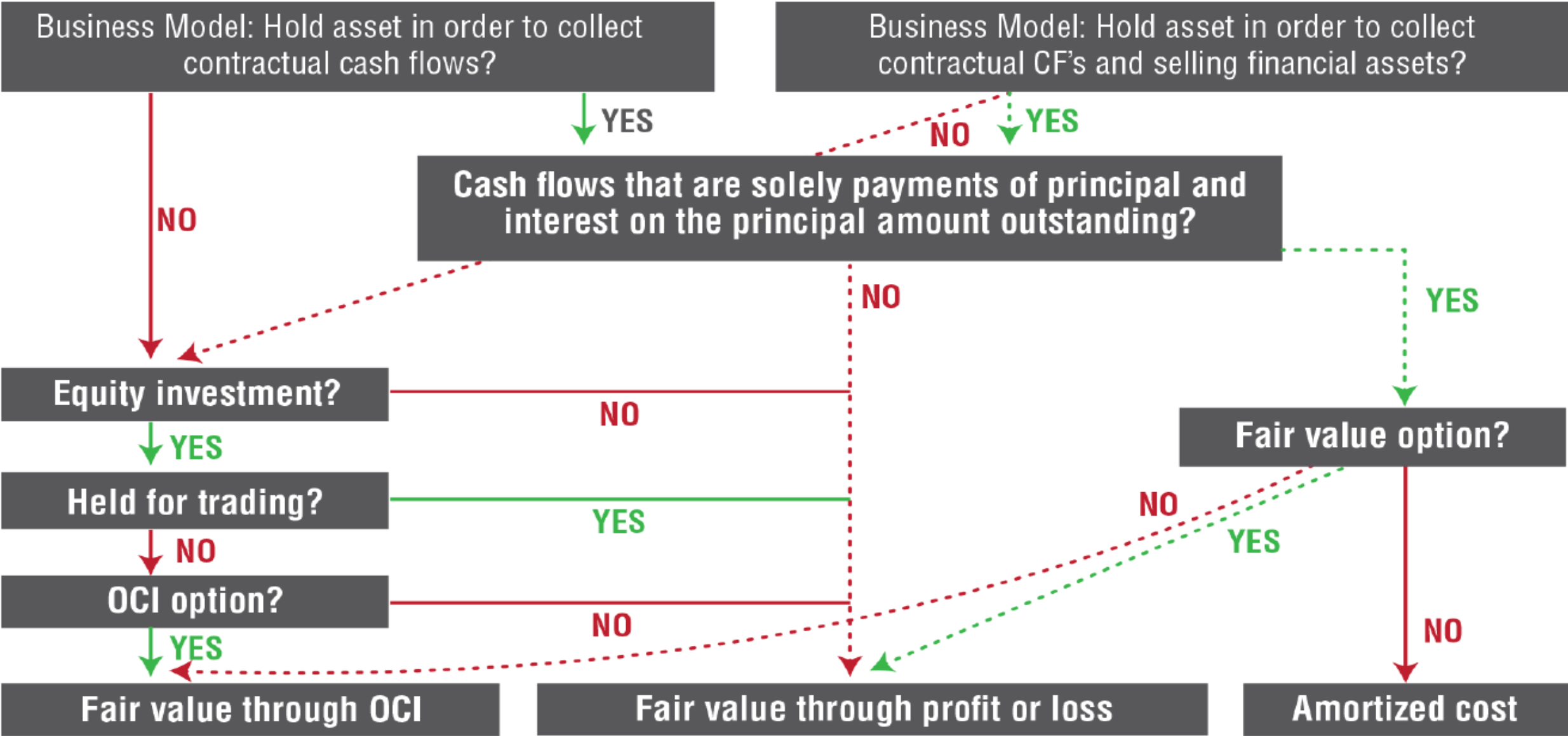


Introduction to the CCAR Framework

CCAR has overlaps with other new and ongoing initiatives



The Decision Process for IFRS 9 Classification Model

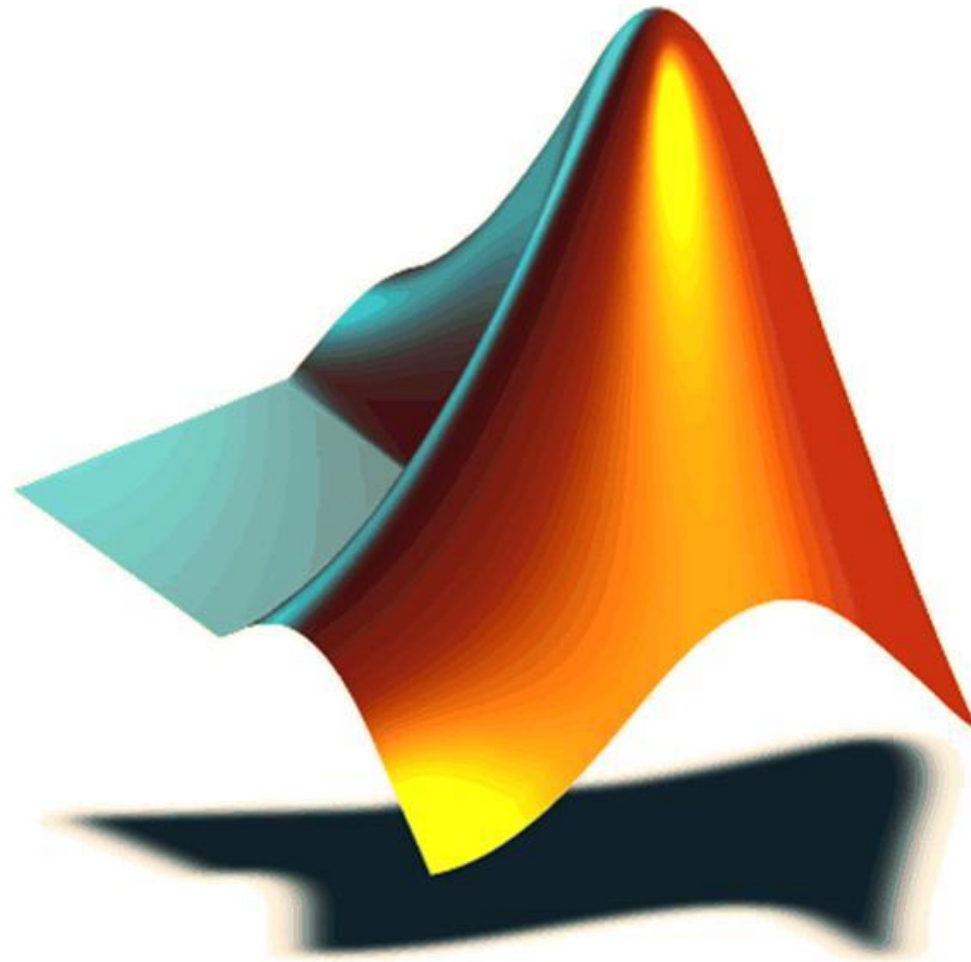


1. Big Macro Environment Changes

2. Disruptive Technologies

3. More Regulations

MATLAB



How others are coping with
these challenges

JP Morgan: Scaling Research

Empirical Issue Observation (Buy-side Research)

❑ Factor Analysis

- **Research Activity: Return decomposition (>100 factor-dimension)**
- **1 time-series decomposition (desktop MATLAB) returns < 60 Sec**
- **Decom of 1,000-10,000 return time-series “does not” complete**
- **Long-run processes prone to “failures” and take time to “repeat”**

❑ Portfolio Construction

- **Research Activity: Optimization-driven Security-Selection**
- **1 Portfolio Construction (desktop MATLAB) returns in time**
- **Optimize 500 Portfolio “does not” complete in time**
- **Long-run processes prone to “failure”**
- **Portfolio Construction frequently “misses” Market**



Scope of Discussion (Buy-side Research)

□ Alpha Modeling

- Bottom-up Research - Investible Universe Selection, Ranking and Pairing
- Top-down Research - Asset Allocation by:
 - ❖ Region
 - ❖ Country
 - ❖ Sector
 - ❖ Factors
 - ❖ Asset Classes
- Currency Overlay Algorithm
- Exotic Alpha signal generation

□ Risk Modeling

- Fundamental Models
- Macro Models
- Statistical Models

□ Tax Efficiency Research

□ Transaction Cost modeling

- Linear/Non-Linear Models
- T-Cost Estimates (Pre-Trade)
- T-Cost Analysis (Post-Trade)
- Real-time Trading signal Generation



Techniques

Large scale:

1. Simulations (including flavors of Monte Carlo)
2. Regressions
3. Optimizations
4. Exotic, Big and Unstructured Data collection
5. Data Analysis of #4, with AI capability
6. High-speed transactional and market data collection
7. Data Analysis of #6
8. Historical time-series data collection (Analytics)
9. Data Analysis of #8
10. Back-Test
11. Stress-Test



Challenges

Desktop-driven Research faces challenge

- ❑ Lack of Advanced visualization
 - Highly customizable UI
 - Cutting-edge visual elements
 - Speed and Performance
 - Portable UI
- ❑ Lack of Enterprise Data Platform
 - Enterprise Data Platform
 - Big and Unstructured Data
- ❑ Lack of Scalable computational platform, specifically:
 - In-Engine Data Usage, lack of:
 - ❖ Parallel Data extraction
 - ❖ Large Scale and Distributed Data caching
 - **Desktop-based Computational engine – scale challenged:**
 - ❖ **Some lack of threading capability**
 - ❖ **Most lack of horizontal scalability**



Scaling Research (generalized solution)

- ❑ Transition from Research (Desktop) to Production (Server-side)
- ❑ String it together:

Research Activity:

Desktop:

MATLAB (Compute)
Terminals (Analytics Data)
Database (User Data)

Production Activity:

Desktop:

Visualization
(Advanced UI)

Compute Server(s):

MPS (Compute)
Data Preparation
Service Provider

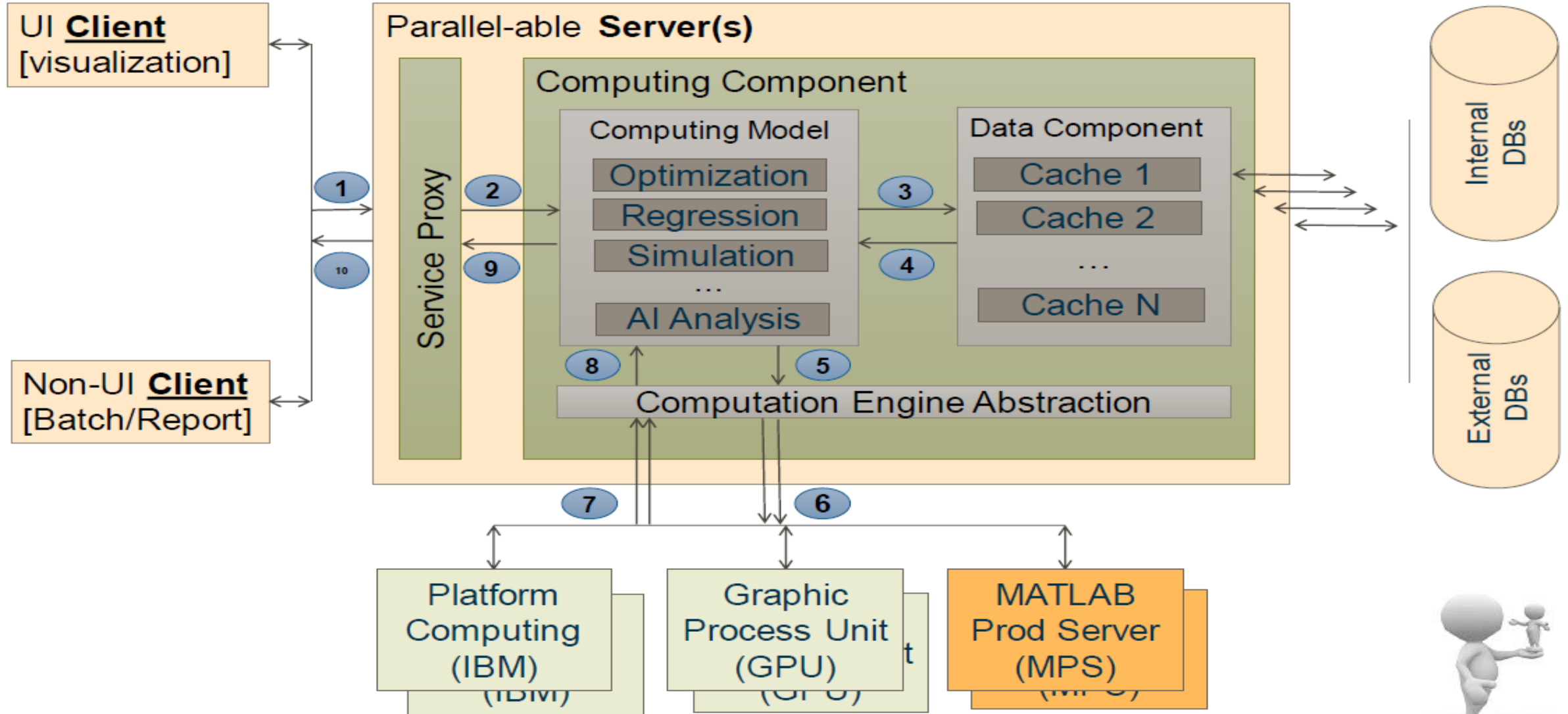
Data Server(s):

Analytic Data
User Data



Scaling Research (generalized solution)

Diagrammatic View:

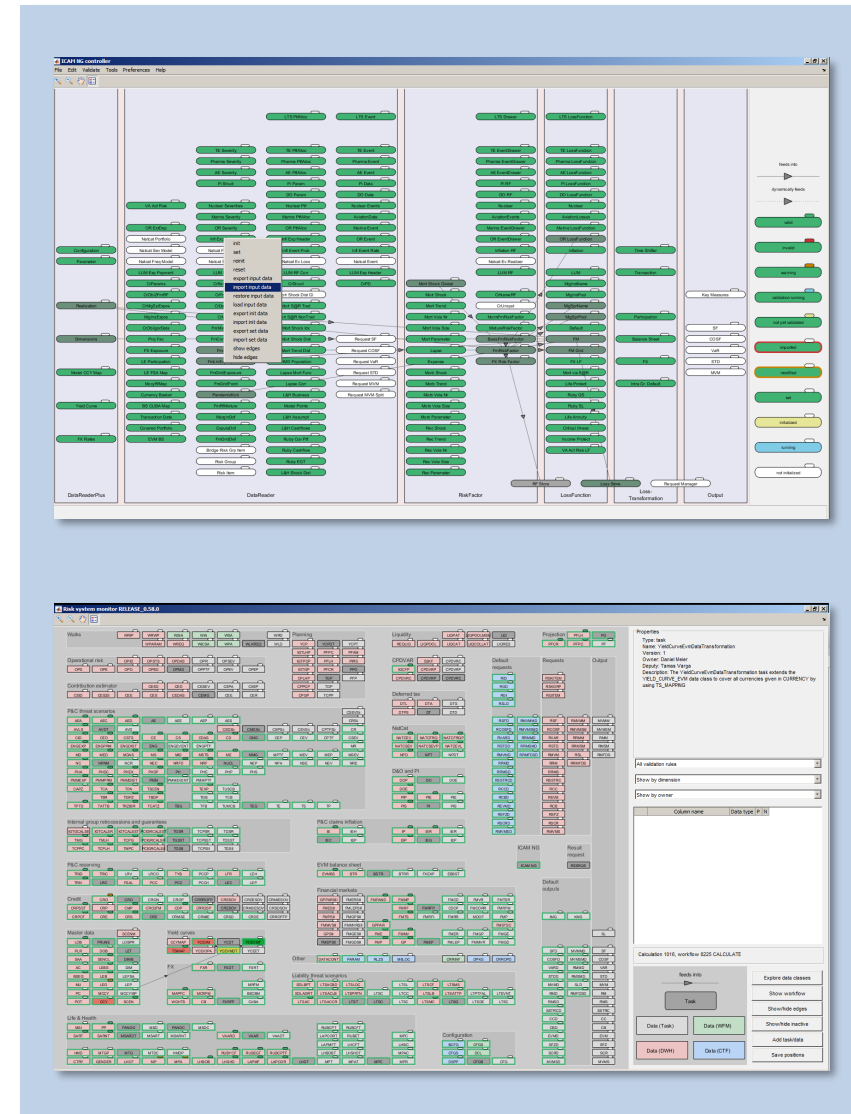


Swiss Re: ICAM

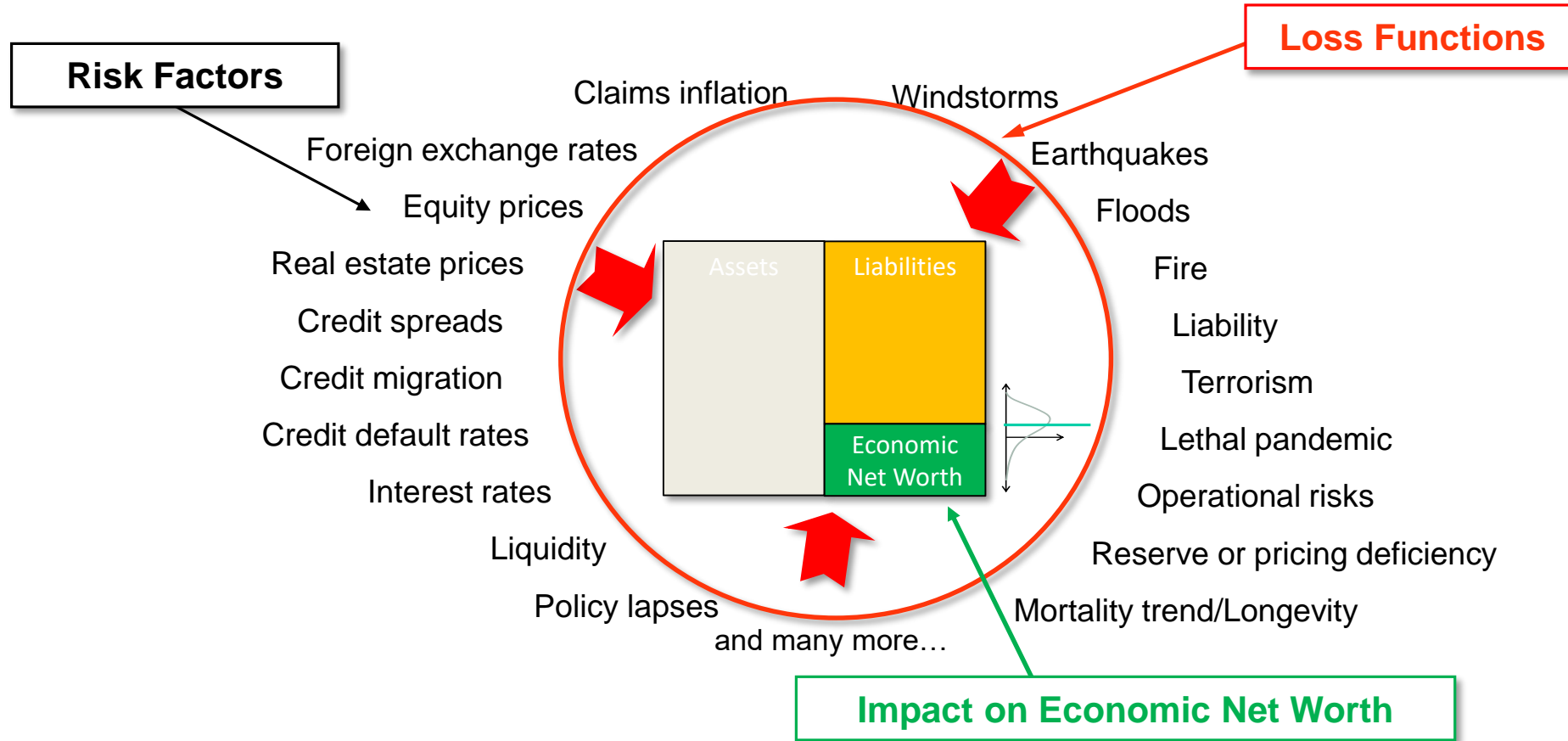
(Internal Capital Adequacy Model)

Swiss Re's Internal Risk Model ICAM (internal capital adequacy model)

- Long history of using an internal risk model to steer the company and for regulatory purposes: Swiss Solvency Test (SST) and Solvency II
- For a decade, Swiss Re has used **MATLAB** to implement its internal risk model **ICAM**
- ICAM is developed/maintained by **Risk Modelling**, a team of 13 people with a broad range of educational backgrounds

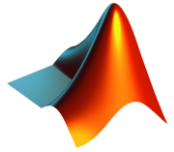


ICAM Overview



An integrated risk model is needed to understand the aggregate **joint** impact of all risk factors on the total economic balance sheet

Why MATLAB?

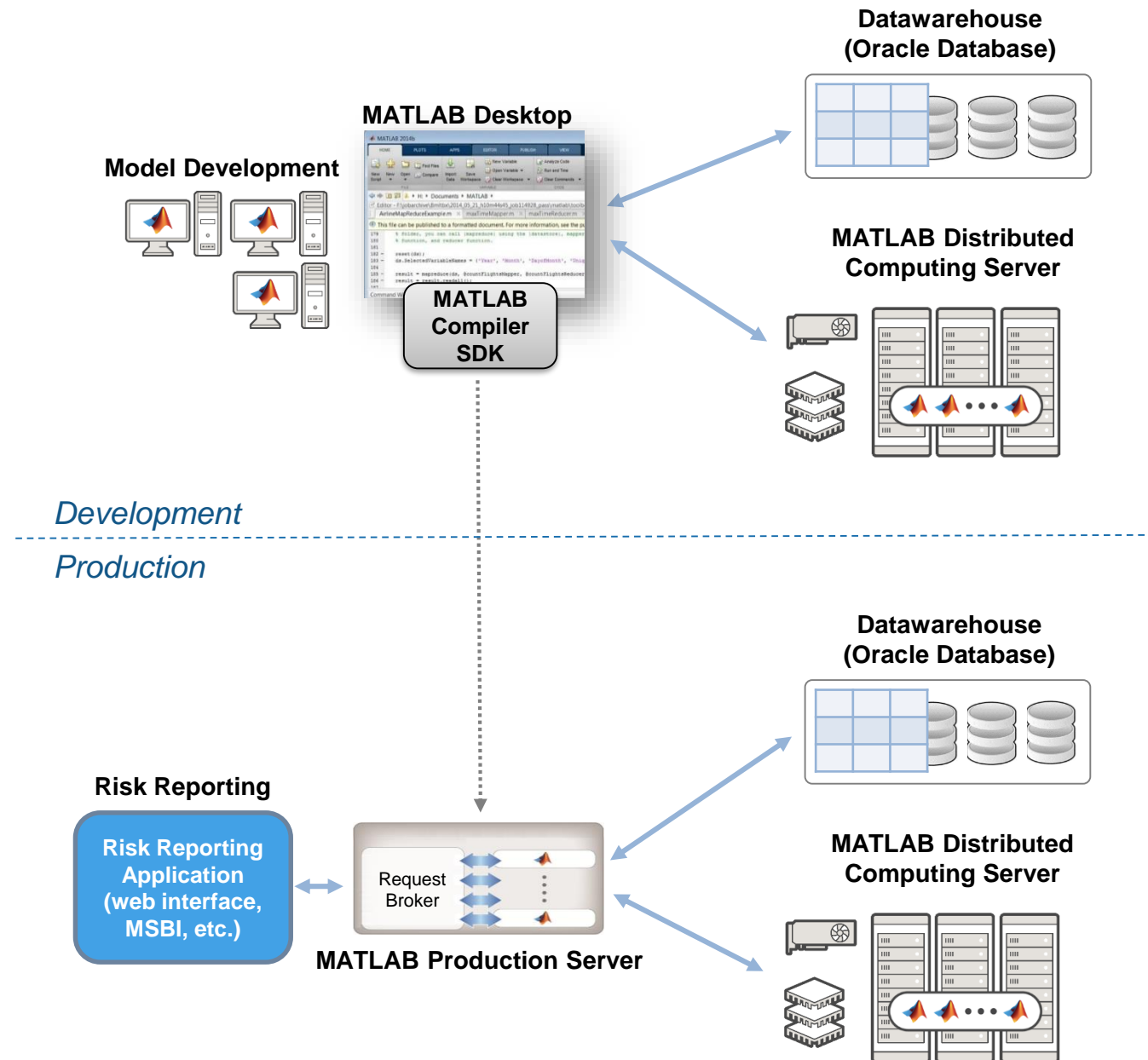


“MATLAB approach” – why and how are we using MATLAB?

- All-in-one solution: parallel computing, data import/export, profiler, debugger, unit testing framework, GUIs, algorithm collection, speed, etc.
- Flexibility for Risk Modellers
- KISS principle (keep it safe, simple, smart, etc.)
- MathWorks is a strong partner to avoid FOMO (fear of missing out) while current tools landscape is growing too fast to follow

System Architecture

- Model development in development (and training) environment, 160 workers on MDCS, use of Parallel Computing Toolbox, 30+ users working directly with MATLAB
- Generation of risk reports in production environment, 224 workers on MDCS, risk reports essentially are consumed by the whole company as well as external stakeholders, e.g. regulators, auditors, rating agencies, etc.



ICAM Demo (running on modified/artificial data)

ICAM main user interface

Data visualization

Legal entity network

Export/modify/import functionality for all objects

Well-defined objects (risk factors, loss functions, loss transformations, etc.) keeping track of all dependencies

Dependencies

Contributions to shortfall

Master data hierarchies

ICAM Demo (running on modified/artificial data)

Risk System monitor

Validation rules run on data classes

All data classes and tasks have an owner/deputy, description, version

Keeping track of all data flows

Tasks (transformations, filters, models, pre-processing, etc.)

Data classes (simple tables)

Source: Swiss Re

The screenshot displays the 'Risk System Monitor' application window. The main area is a grid of data classes and tasks, organized into categories such as 'Walks', 'Operational risk', 'P&C threat scenarios', 'Internal group retrocessions and guarantees', 'P&C claims inflation', 'EVM balance sheet', 'Financial markets', 'Other', 'Liability threat scenarios', 'Life & Health', 'P&C threat scenarios', 'P&C reserving', 'Credit', 'Master data', 'Yield curves', 'FX', and 'Liquidty'. Each data class or task is represented by a small icon with a label. A central orange box highlights the text 'Keeping track of all data flows'. On the right side, there is a 'Properties' panel for a selected task, showing details like 'Type: task', 'Name: YieldCurveEvmDataTransformation', 'Version: 1', 'Owner: Daniel Meier', and 'Deputy: Tamas Varga'. Below the properties panel, there are dropdown menus for 'All validation rules', 'Show by dimension', and 'Show by owner'. At the bottom right, there is a 'Calculation 1016, workflow 8225 CALCULATE' section with a 'Task' box and a 'Data (WFM)' box, along with buttons for 'Explore data classes', 'Show workflow', 'Show/hide edges', 'Show/hide inactive', 'Add task/data', and 'Save positions'. The top left corner shows the window title 'Risk system monitor RELEASE_0.58.0' and standard window controls. The top right corner shows the MathWorks logo.

RaboBank: Goal Monitor

Rabobank needs Goal Monitor to serve clients!



Rabobank

- Questions of clients arise, when they come for advice regarding their financial situation:
 - What can I expect after 20 years of investing?
 - What is the (downside) risk of my portfolio over time?
 - What is the chance that I support my children to university?
- As financial markets are unpredictable, Rabobank does need to provide insights though.
- We simulate the dynamics of the financial markets with Goal Monitor!

Kans dat u uw doel bereikt ⓘ



> [Wijzig beleggingsdoel](#)

> [Toon suggesties](#)



Hoe wilt u uw doel bereiken? ⓘ

Huidige portefeuillewaarde € 4.465.749

Doelbedrag € 50.000.000

Looptijd 37 jaar

Einddatum 01 01 2054

Extra inleggen

Eenmalige inleg € 0

Periodiek inleggen € 1.000

Met welke frequentie wilt u inleggen?

Per Maand

Verwachting ⓘ



Portefeuillewaarde ⓘ	€ 4.466.749
Goede markt ⓘ	€ 82.978.920
Normale markt ⓘ	€ 32.615.230
Zeer slechte markt ⓘ	€ 8.022.934

Observations

&

Questions...



Rabobank

- Yearly € 2 million for an external system
- But...other parties also buy the same system for their clients
- But...we don't have any suitable software
- Is it really that hard to build internally??!!
- Do we have the expertise to build internally though?
- Which software would be the best for Rabobank?



Before MATLAB...



Rabobank

Quantitative
Analysts



Programmers of
the calculation
rules

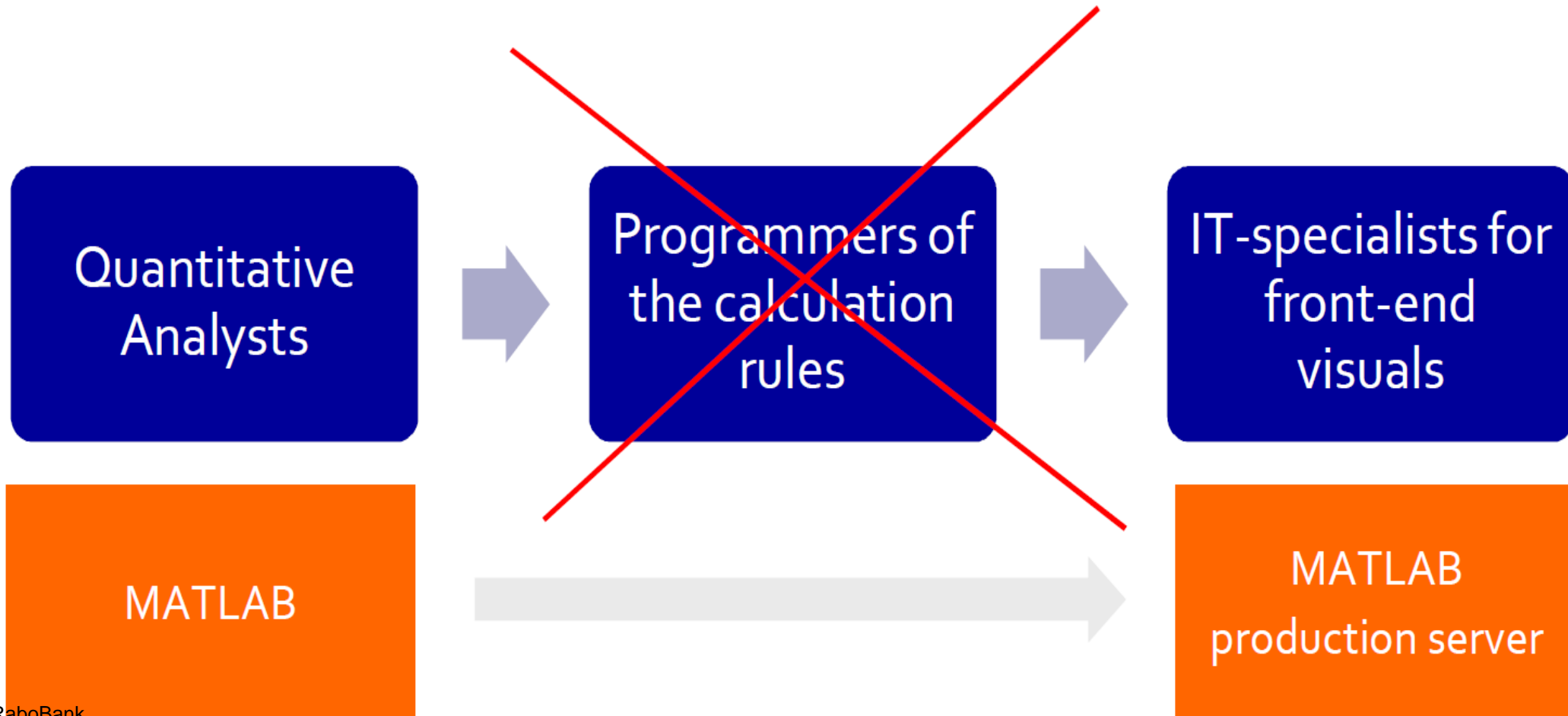


IT-specialists for
front-end
visuals

...after MATLAB



Rabobank



Another saving! \$ € £



- **Time = Money!**
- Much quicker implementation of adjustments in source code by the quantitative analysts
- ~~Verification of the programmer's code needed by the quantitative analysts~~

HSBC: Global Risk Platform

HSBC: transparency, common platform

- Adopting MATLAB to accelerate model development and deployment to production
- Sharing models and model development tools across the bank
- Driving consistency and traceability, avoiding compliance issues
- Analysts spend less time on mundane work



1. Big Macro Environment Changes

2. Disruptive Technologies

3. More Regulations

