

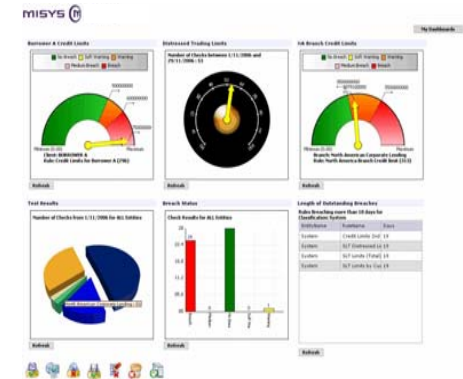
Misys Risk Solutions

Misys Risk Forum, 2nd September 2009

- You are hearing about how varied and complex the ‘risk’ problem is
- *Data, consistency, timeliness, scale, dynamic, importance*

- What do we do?
 - We provide a comprehensive risk framework
 - A series of department solutions, enterprise solutions
 - Complete applications or components
 - Ongoing development, support, improvement
 - Expertise, services, partnerships

- Relevance?
 - The client case studies – many and important
 - The panel discussion – lively and underlines importance
 - The demonstrations shown today – many, available
 - Ongoing product maintenance and original thought



MISYS
CreditRiskVantage: Advances in Credit Modelling
 Yimin Liu Noel McWilliam

Summary: Misys CRV advances an industry Best Practices solution model that captures extreme value risk and the dependence structure that underpins its cause. It provides a robust, scalable, and consistent framework for risk measurement, reporting, and compliance through the CreditRiskVantage.

In July 2008 Misys Risk Group released the Credit Risk Vantage (CRV) model for credit line calculations. It is designed to work with other Misys Risk products, or for use as a stand alone component. It extracts and enhances the analytical framework of CreditRisk to provide the rapid and comprehensive identification of loans that do not fit within a portfolio of loans.

In contrast to J.P.Morgan's Credit Metrics, CRV does not rely upon overly liberal, overly subjective, leading practice multiple "what if" analyses to real time contingencies where speed and performance are critical. The need for rapid results is supported by the following assumptions in the original CRV model for Credit Risk Financial Products. However the best results have been made in the form of a set of best practices assumptions to provide greater accuracy without sacrificing the advantages of simplicity.

While substantial progress has been made in this sector, many problems have remained and indeed many new questions have been raised in the wake of the credit crunch. In particular recent events have re-emphasized the need for a robust and accurate representation of extreme value risk.

As a response to these concerns, the Financial Risk Grouping and Research (FRG) team within Misys Risk have developed cutting-edge partner analysis techniques for the identification and quantification of extreme value risk and the sometimes complex relationship existing between them. The primary aim of these methods is to use CRV framework not only allow one to measure portfolio effects of

but extreme and often but also address key problems present in the more advanced variants of CreditRisk.

As we illustrate, our model allows for a significantly greater degree of flexibility in the range of sector correlations that may be estimated, not just for large assets, but for the full line it is possible to capture smaller correlations between assets. Our approach also allows for conditioning of the extreme value probabilities on the more recent sector risk values, thereby addressing the "through-the-cycle" fluctuations of other model estimates.

By allowing for an explicit representation of the dependence between extreme values within CRV the FRG team have paved the way for a model that captures the dynamic behaviour of extreme values and the manner in which they propagate through markets over time.

The State of Modelling

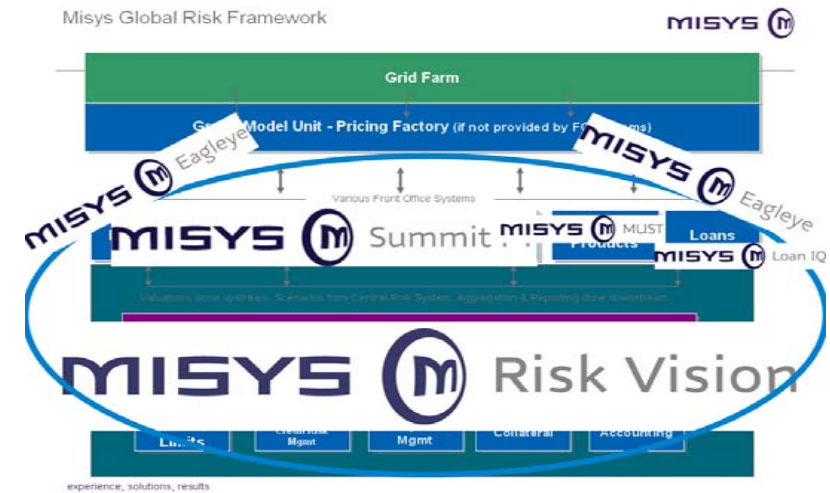
Those familiar with CreditRisk will recall that the principal stochastic variable of interest in the original model is probability. Thus, unlike other models, the random nature of probabilistic themselves are directly and explicitly represented in the model.

As has been clearly established, dependence can be achieved by allowing each obligor default to be dependent upon a common set of "sector risk factors", whereby each obligor's individual dependence is characterized by a set of sector weights specific to it.

By measuring each sector risk factor to be independent and Gaussian distributed one may retain into natural responses for default and loss distributions. Of course this is a crucial omission when in the real world sectors are not generally independent. More naturally it ignores the propensity of typically non-linear risk factors to display nonlinear dependence in

- Misys substantial Pedigree in providing Risk solutions and expertise

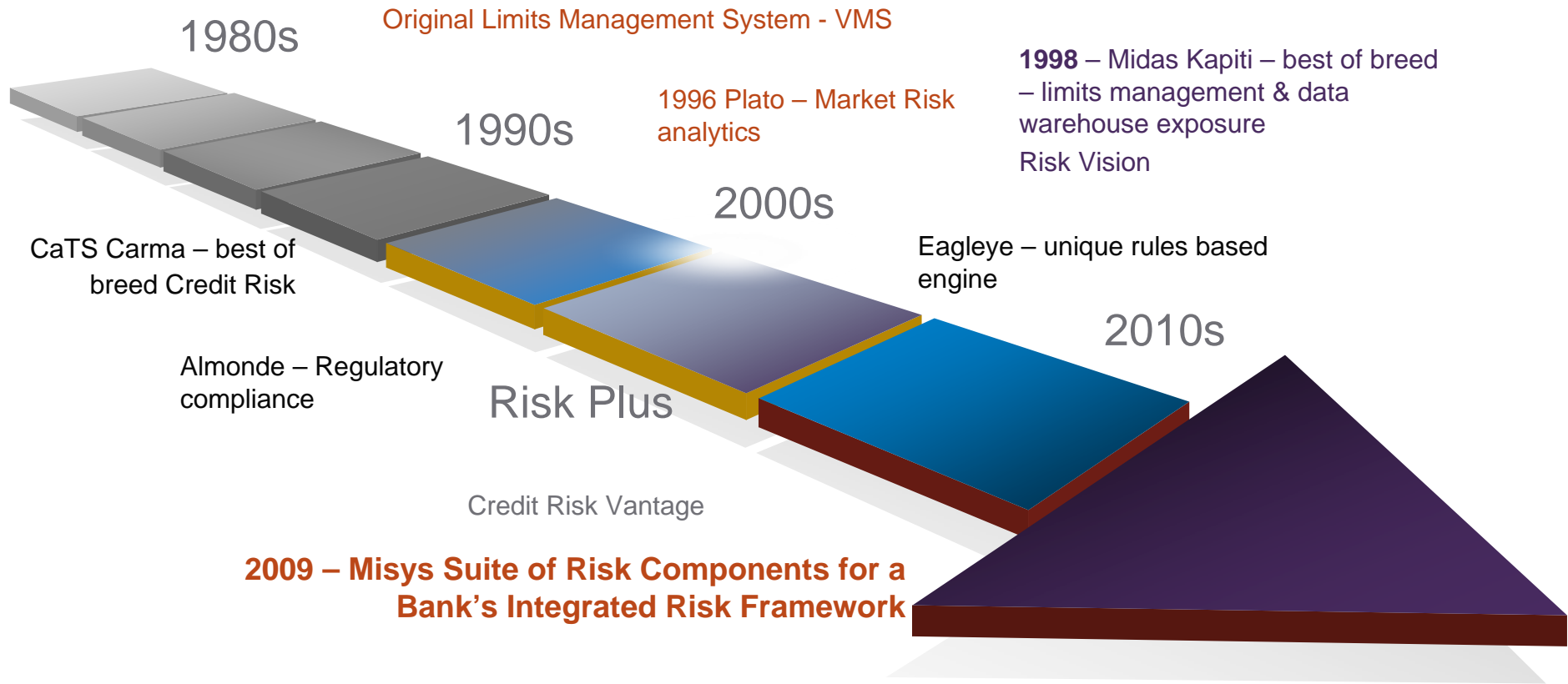
- Midas-Kapiti, Risk Vision
- CaTS, Carma
- Plato, Opics Risk Plus
- Eagleye
- Almonde
- Credit Risk Vantage



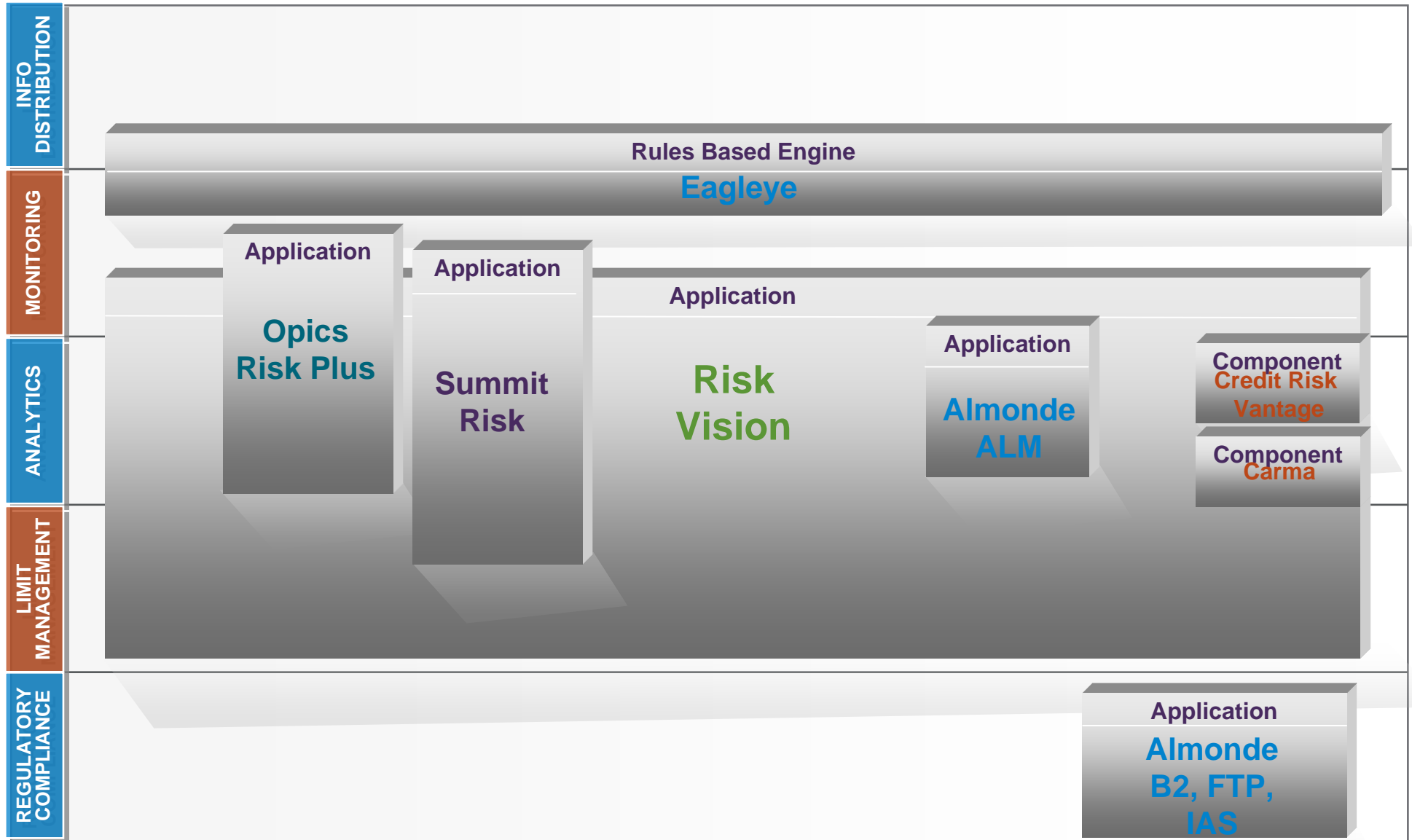
- Integration as Application or Open

- Department - Opics Risk Plus, Summit Risk, Eagleye, Almonde
- Enterprise - Risk Vision, Eagleye, Almonde
- Components – Credit Risk Vantage, Carma, Risk Plus

Evolution of Misys Suite of Integrated Risk Solutions

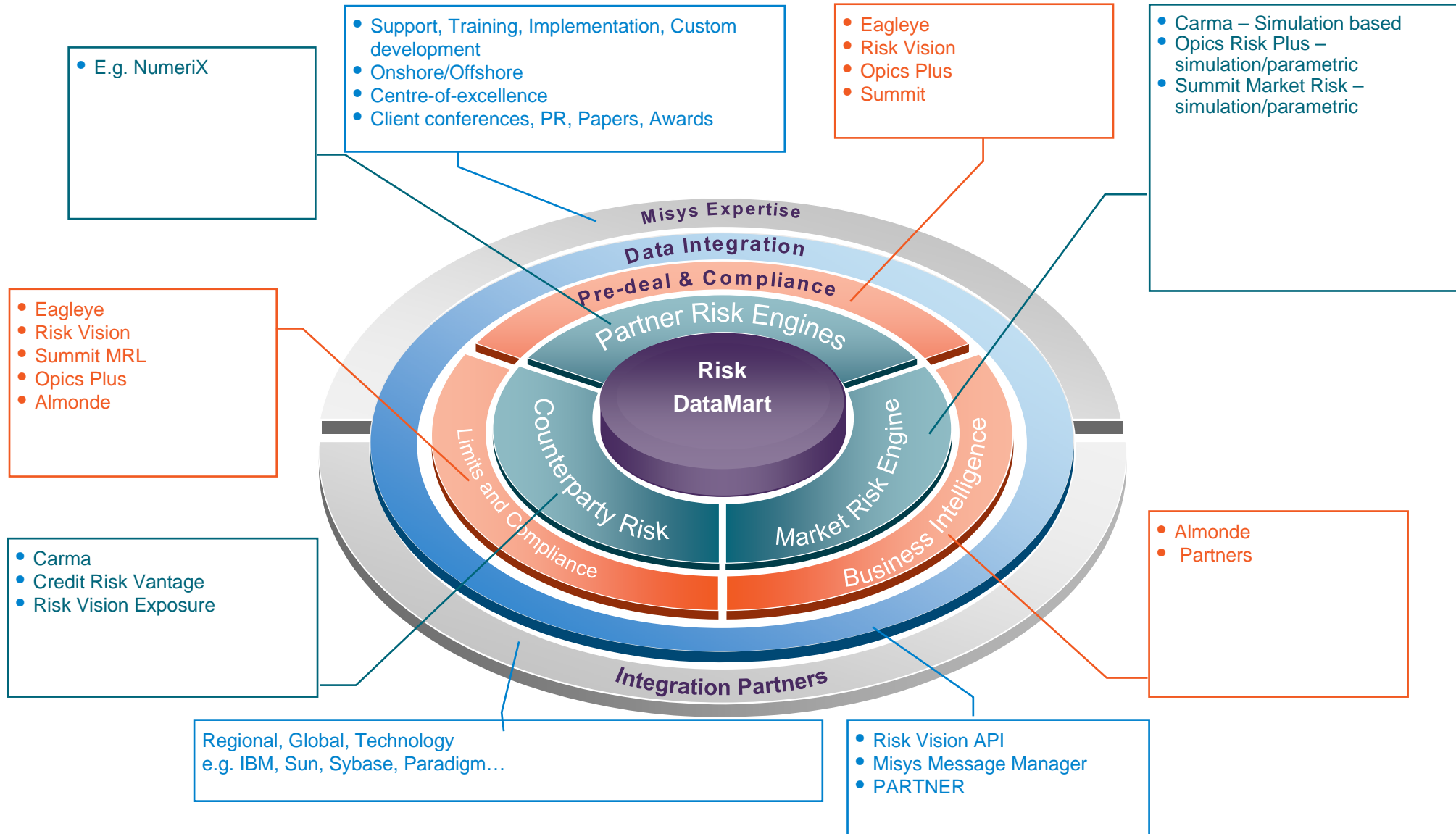


The Complete Risk Portfolio

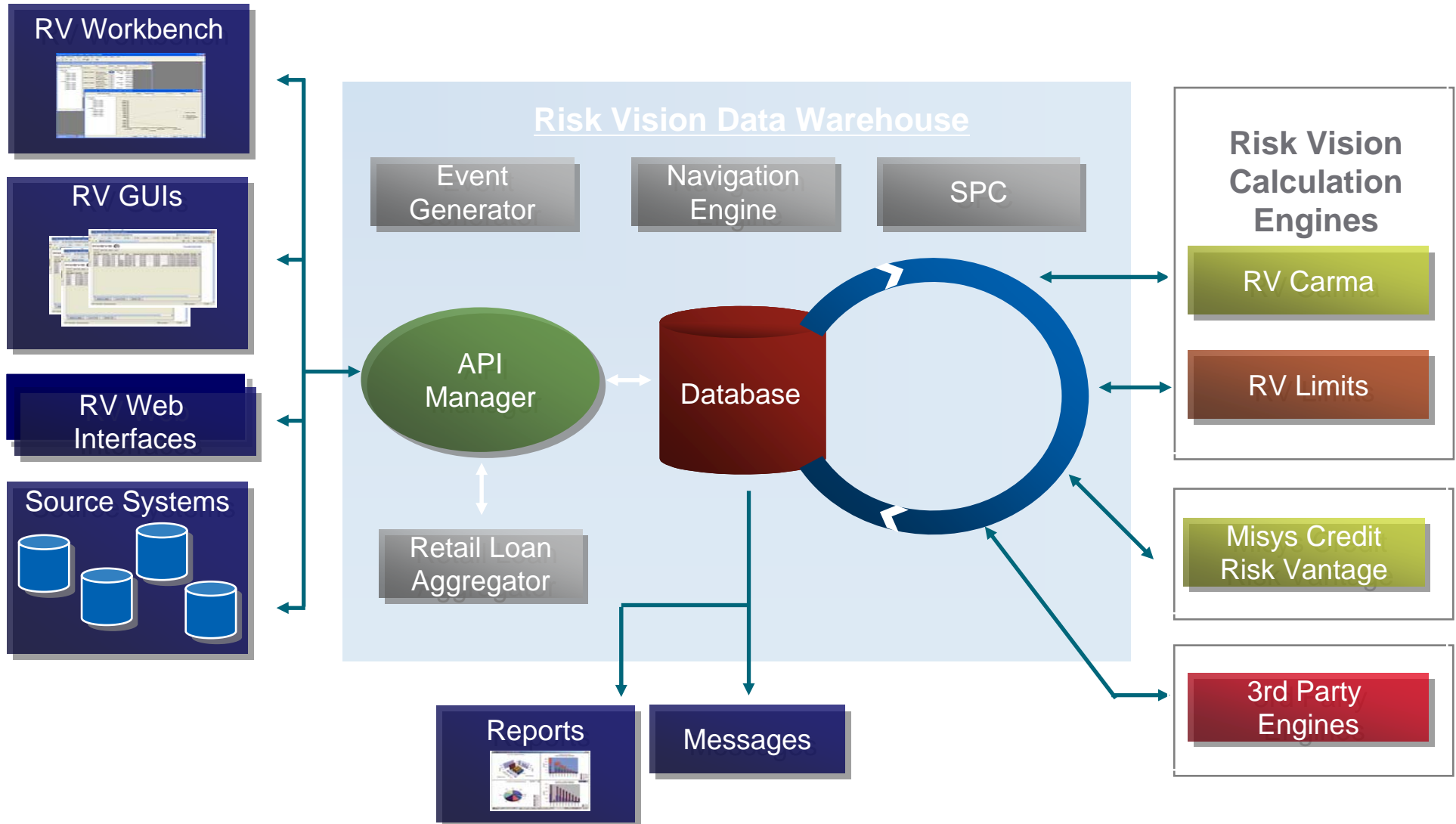


The Misys Risk Framework and Components

Expertise, Services and Solutions



-
- Following are individual slides on each risk offering
 - What are they
 - What do they do
 - Examples of client use
 - Examples of benefits
 - Necessarily quick overview
 - Each offering is extensive and
 - Each are available to see
 - Follows
 - Risk Vision
 - Almonde
 - Opics Risk Plus
 - Eagleye
 - Credit Risk Vantage
 - Risk Vision as integrated ERM with Misys solutions, Summit, Opics Plus



Trading Book

- Equities
- Fixed Rate Notes
- Cash Balances
- Foreign Currency Spot, Forward, Swaps
- Interest Rate Swaps
- Caps, Floors, Collars
- Spread Lock Swaps
- Quanto Swaps
- Equity Swaps
- Commodity Swaps, Options, Spreadtion
- Interest Rate Options
- Binaries, Barriers, Double Barriers
- Compounds
- Swaptions, Constant Maturity Swaptions
- Contingent Premium Options
- Average Price/Strike Options
- Single Touch / Double Touch Options
- Speadtions and Commodity Options
- Credit Derivatives.....

Banking Book

- Loans – various kinds (Annuity etc)
- Deposits
- Participations
- Facilities
- Collaterals
 - Cash Collateral
 - Guarantees
 - Letter of Comfort
 - Quoted Collateral
 - Export Credit Insurance
- Cover Assignment Groups**
 - Relationship between Covers and Trades
 - Ranking of Covers and Trades

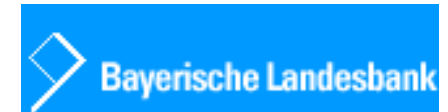
Risk Vision Generic Trades and Risk Vision Linked Trades

✓ Over 1 million Limits to 14,000 Limits

✓ Over 700,000 transactions to 20,000 transactions held

✓ 5000 plus users to 30 users

✓ Pre deal check in 0.100 seconds



Integrated Market & Credit Risk Management with Limits Management.

Risk Vision's trader interface is used for pre-deal checking

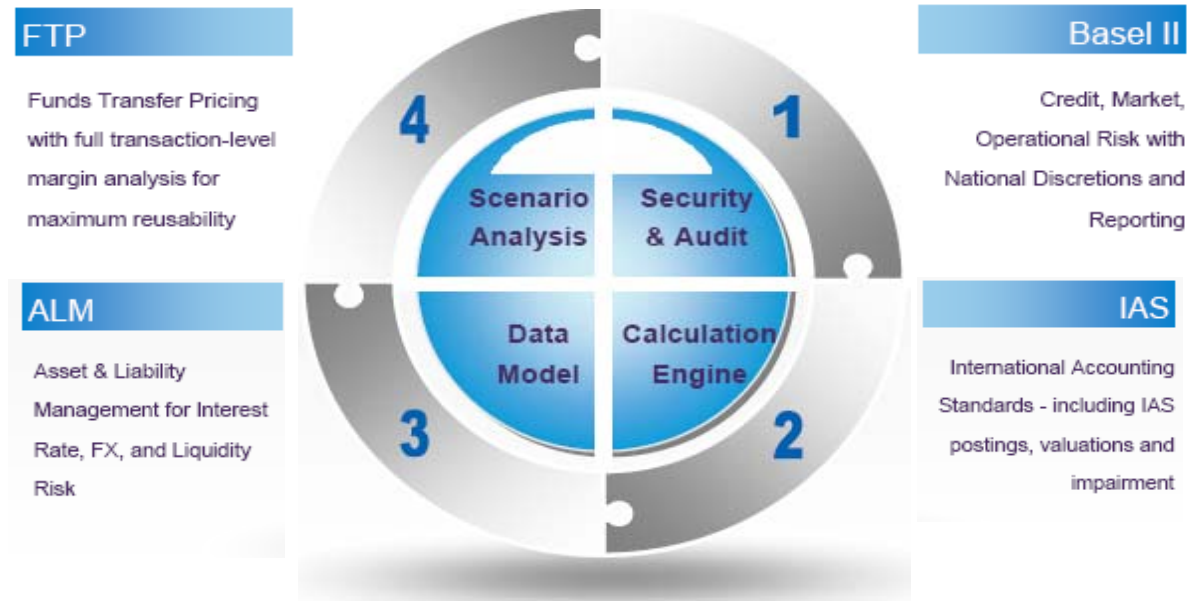
Risk Vision Carma is in use with a Brokerage house for its Credit Risk calculation capabilities and in particular to calculate Credit Margins

Risk Vision acts in many cases as a central hub for limits management across banks international trading, treasury & banking lending operations

Consistent data, real-time, near real-time

Consistent aggregation and dissection

- Modularity
 - Stand-alone or integrated solutions
 - Easily upgraded
- Common components
 - Data model
 - Analytics
 - Scenario engines
 - User interface
- Consistent analysis & calculations
- Cross-department results sharing



PAIN

- **No Consolidated Risk**

No single view of the costs of funding and risk, increased liquidity risk and affecting profit margins

- **No ability to simulate and consider future plans**

Unable to run simulations, and project future growth, and therefore Liquidity and Profit Margins

- **Current Solution was decentralised**

High cost solution provided via 4 separate in-house applications

MISYS SOLUTION

- **Misys Almonde ALM, FTP, and Misys Portal**

Misys ALM & FTP – A consolidated Platform for ALM Risk and Margins Management

Misys Portal – Providing the ability for branches to make requests for funding and pricing

VALUE FOR Client

- **Annual Savings of 500k EUR**

Retirement of 4 legacy environments

- **Supporting Staff Costs Savings**

75% Reduction in Full Time Staff needs

WHY MISYS?

- **Excellent Business Engagement**

Excellent Engagement with Business and IT teams by Sales, Solutions Consulting, Solutions Management & Development

- **The Best Solution**

Only Solution to Meet (& Exceed) the requirements of Societe Generale

Key competitors (Fermat & Risk Pro) failed to meet the Benchmark requirements

Internal Development costs estimated at 4 times those of the Misys Solution

- **Key Value Differentiator**

The Misys Portal added value that the competition could not offer

“The Misys Almonde solution is the only offering in the market that is able to cater for our existing processes for internal Risk Management and FTP monitoring. Additionally, the structure of the Misys Almonde ALM solution enables us to acquire and maintain control easily. We will be able to significantly reduce the current level of manpower dedicated to administration, which will allow us to focus on various simulations of our risks and margins”

- Julien Delbet, Head of ALM, Retail Banking at Société Générale.

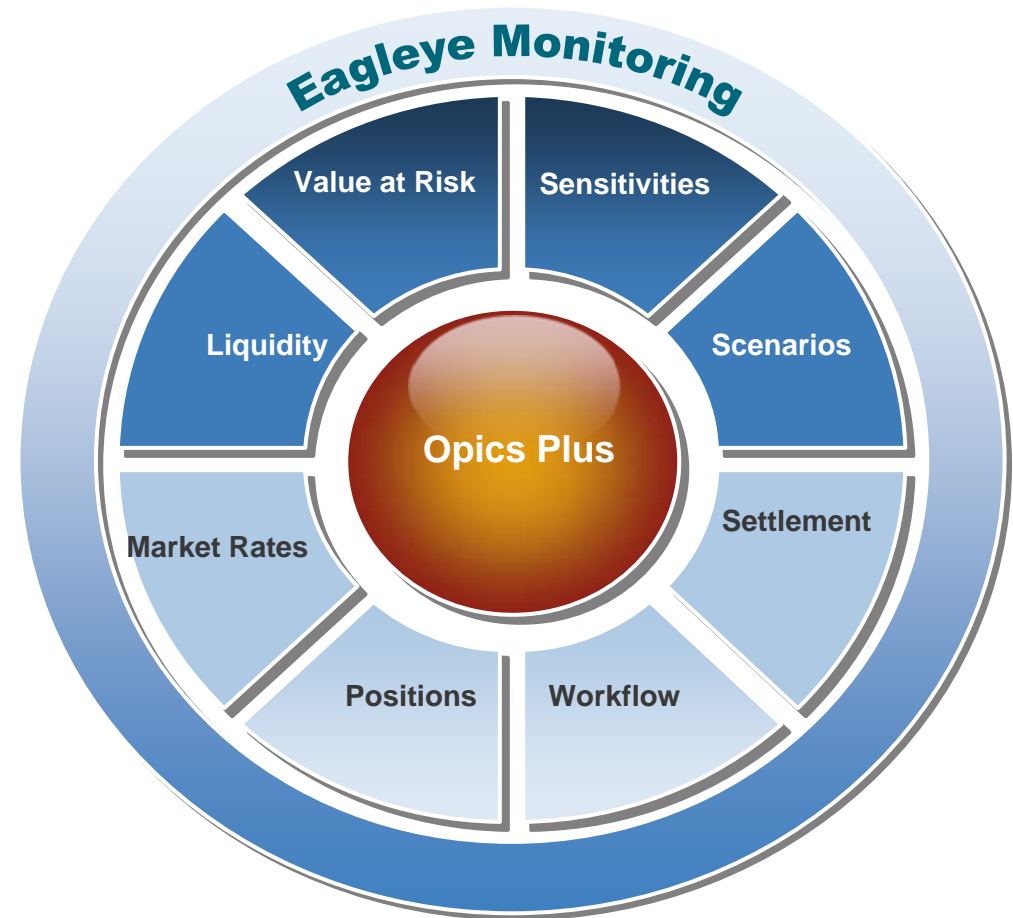
- **Basel 2** : To ensure compliance with basel II within an automated process / tracking updates to regulations, one step reporting
- **IAS** : Provide IAS/39, IAS/32, IFRS/7 compliance
- **ALM** : Support the ALM manager with the latest tools
- **FTP** : Allowing our customers to better manage margins and associated costs, and therefore improve the profit margins, and better price for competitiveness

Customer Examples



Opics Risk Plus delivers middle office Market risk analytics for the banks treasury & trading operations

- Value at Risk (Parametric, Monte Carlo, Historical)
- Hedging/Optimisation, Portfolio Management, Back-testing, Benchmarking & Return Performance Attribution
- Integrated pre-deal checking capability with Eagleye for Opics Plus
- Eagleye triggers the execution of risk calculations as well as the usual notifications of exceptions to users.



“Treasuries & Trading departments using Market Risk analytics within the middle office. Opics Risk Plus facilitates reporting this in to the risk committee”



“Hedge funds – investment managers use Opics Risk Plus for Portfolio Risk Management”



“Interactive with front office as a trade decision support tool”



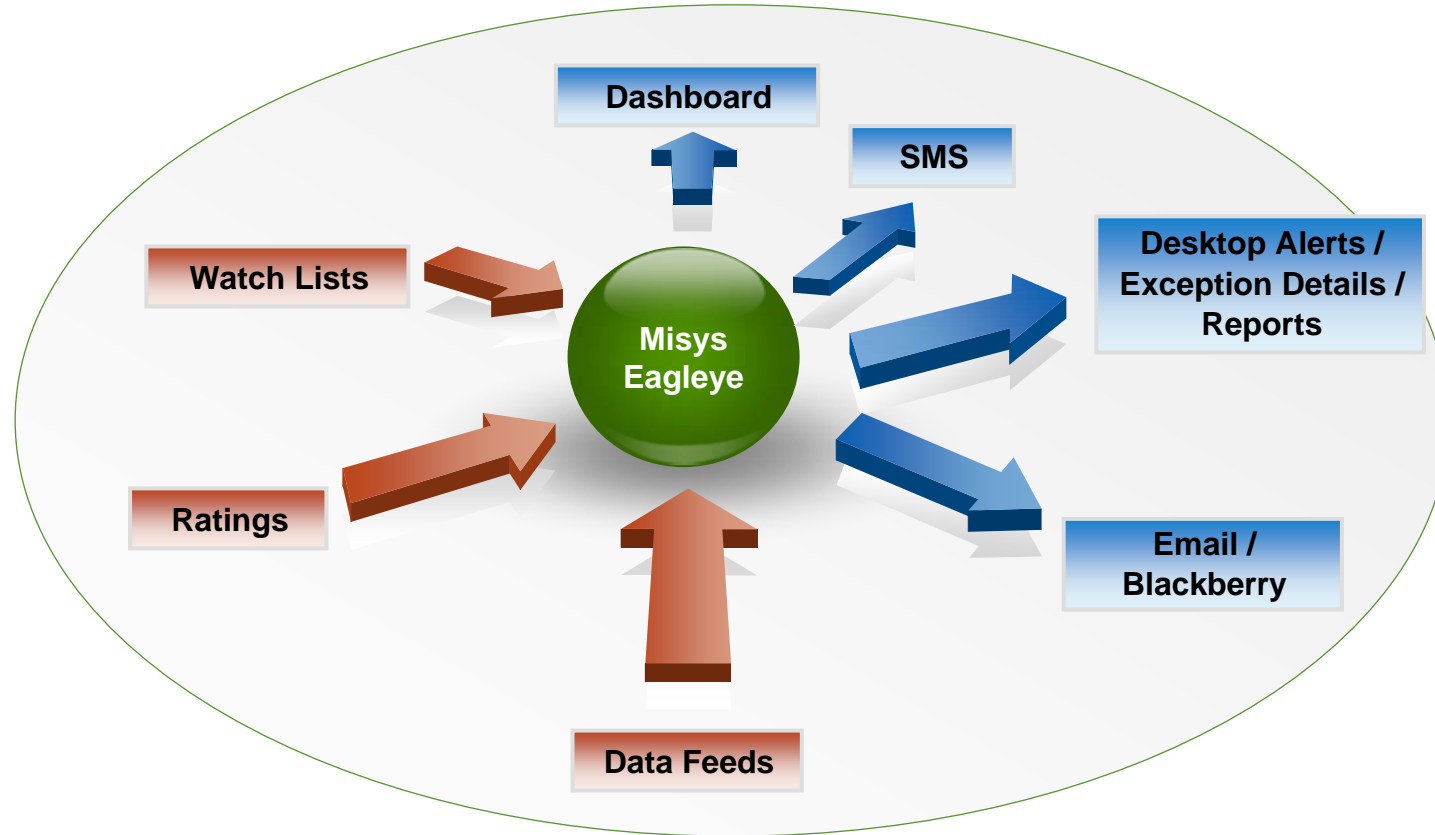
“Front office relying on the middle office numbers being generated by Opics Risk Plus”



Misys Eagleye Provides A Single Common Monitoring Platform That Enables An Environment of Protection



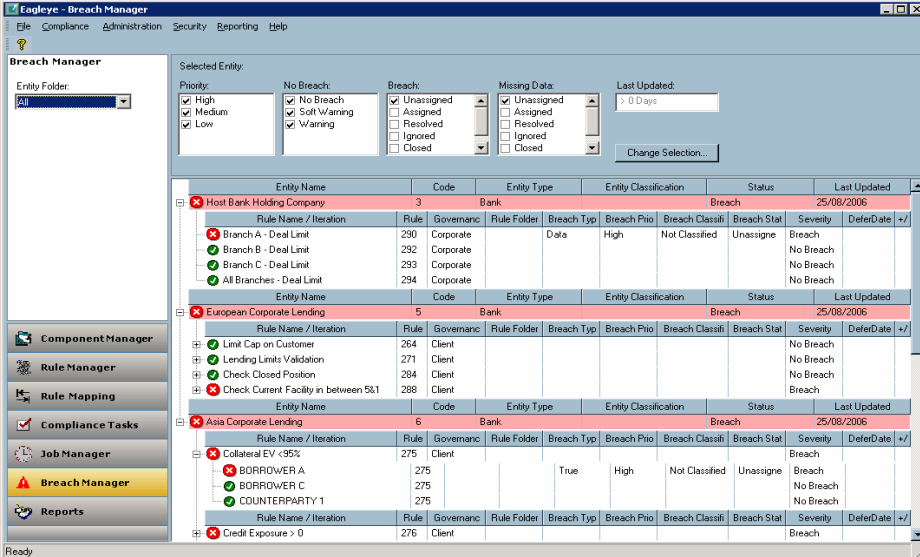
- Continuously and proactively monitors for exceptions
- Independently monitors adherence to policies
- Delivers alerts of breaches by SMS, email or desktop alerts
- High level view for C level through a custom dashboard
- Reduces manual tracking
- Flexible data structures enables extensibility to monitor across multiple systems



Providing a powerful and flexible common platform offering an integrated proactive monitoring service delivering an environment of protection

Breach & Warning Analysis

Dashboards for Management by Exception



Eagleye - Breach Manager

Selected Entity: [Entity Name]

Priority: High Medium Low

No Breach: No Breach Soft Warning Warning


Breach: Unassigned Assigned Resolved Ignored Closed

Missing Data: Unassigned Assigned Resolved Ignored Closed

Last Updated: > 0 Days

Entity Name	Code	Entity Type	Entity Classification	Status	Last Updated				
Host Bank Holding Company	3	Bank		Breach	25/08/2006				
Rule Name / Iteration	Rule	Governanc	Rule Folder	Breach Typ	Breach Prio	Breach Classif	Breach Stat	Seventy	DeferDate
Branch A - Deal Limit	290	Corporate		Deal	High	Not Classified	Unassigne	Breach	
Branch B - Deal Limit	292	Corporate						No Breach	
Branch C - Deal Limit	293	Corporate						No Breach	
All Branches - Deal Limit	294	Corporate						No Breach	
European Corporate Lending	5	Bank							25/08/2006
Rule Name / Iteration	Rule	Governanc	Rule Folder	Breach Typ	Breach Prio	Breach Classif	Breach Stat	Seventy	DeferDate
Limit Cap on Customer	264	Client						No Breach	
Lending Limits Validation	271	Client						No Breach	
Check Closed Position	284	Client						No Breach	
Check Current Facility in between 5&1	289	Client						Breach	
Asia Corporate Lending	6	Bank							25/08/2006
Rule Name / Iteration	Rule	Governanc	Rule Folder	Breach Typ	Breach Prio	Breach Classif	Breach Stat	Seventy	DeferDate
Collateral EV <95%	275	Client						Breach	
BORROWER A	275			True	High	Not Classified	Unassigne	Breach	
BORROWER C	275							No Breach	
COUNTERPARTY 1	275							No Breach	
Rule Name / Iteration	Rule	Governanc	Rule Folder	Breach Typ	Breach Prio	Breach Classif	Breach Stat	Seventy	DeferDate
Credit Exposure > 0	276	Client						Breach	

Alerts requiring Acknowledgement



Alert 10 of 10

Rule Breached

Global Credit Limits
Tokyo Branch
09:13 18 Jan 07

Acknowledge

Instant Notification

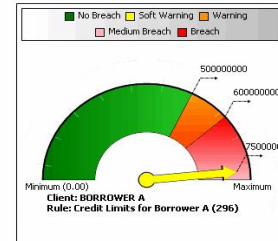


administrator@misys.com

Branch A - Deal Limit reports One Breach
4 checks were performed.
The following rules breached:

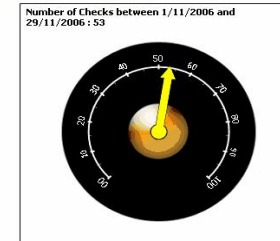


Borrower A Credit Limits



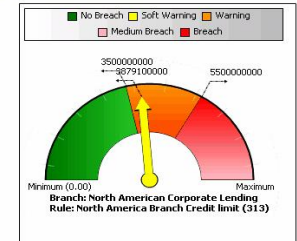
Refresh

Distressed Trading Limits



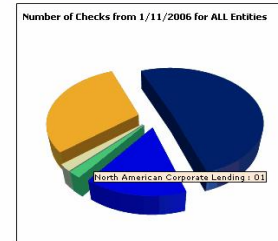
Refresh

NA Branch Credit Limits



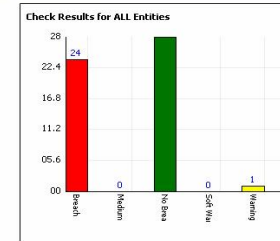
Refresh

Test Results



Refresh

Breach Status



Refresh

Length of Outstanding Breaches

Rules Breaching more than 10 days for Classification: System

EntityName	RuleName	Days
System	Credit Limits 2nd	19
System	SLT Distressed Lii	19
System	SLT Limits (Total)	19
System	SLT Limits by Cui	19

Refresh



Commercial Lending

- ✓ Trading limits
- ✓ Credit administration limits
- ✓ CLO management
- ✓ Corporate governance
- ✓ Business process monitoring

Treasury & Capital Markets

- ✓ Trading controls
- ✓ Exposure monitoring
- ✓ Watch/restricted lists
- ✓ Investment mandates
- ✓ Position monitoring
- ✓ Gap monitoring
- ✓ Market risks limits
- ✓ Operational Controls

Market and Credit Risks

- ✓ Credit utilisation against collateral held/ pledged
- ✓ Transactional Notional limit, Rate/ Price tolerance
- ✓ Stop Loss Limit, Cumulative loss (including monthly, yearly loss) limit
- ✓ Market Scenario and Sensitivities (PV01, Duration, Delta, Vega, Gamma,...)
- ✓ Open Position Limit (daytime and overnight)
- ✓ Market and Credit exposures
- ✓ VaR Limit, Regulatory Capital and Economic Capital;
- ✓ Country, Currency and Counterparty exposure limits

Proactive Monitoring Enabled through Events or Scheduled

Supplemented by Pre-Deal + Remote Authorisation

Monitoring internal policies and gap monitoring



Monitoring group credit limits, cumulative P&L, FX positions



Monitoring credit utilization against collateral value



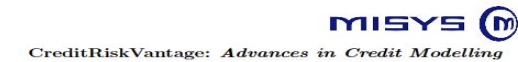
Monitoring counterparty and counterparty group credit and settlement limits, time-banded bond open position limits, portfolio VaR/economic capital requirement /minimum capital requirement



A new component to provide access to advances to thinking in credit modelling
 “...an industry first Gamma Mixture model that captures extreme value risk and the dependence structures that emerge in times of crisis...”

Key offering by Misys for two important reasons

1. Introduces new research to review conventional thinking
2. Build as an interoperable component to be available across all Misys products



Yimin Liu Noel McWilliam

Summary: Misys CHV showcases an industry first Gamma Mixture model that captures extreme value risk and the dependence structures that emerge in times of crisis. *Keywords:* Extreme Value Risk, Tail Dependence, Negative Sector Correlation, Through-the-Cycle Default Risk

In July 2009 Misys Risk Group released its Credit Risk Vantage (CHV) model for credit loss calculation. Readily integrable with other Misys Banking products, or for use as a stand alone component it extends and enhances the analytical framework of CreditRisk[®] to provide the rapid and unambiguous determination of losses due to default within a portfolio of loans.

In contrast to J.P.Morgan’s Credit Metrics, CHV does not rely upon costly Monte-Carlo techniques making possible multiple “what if” analyses in real-time environments where speed and performance are critical. This need for rapid results necessitated simplifying assumptions in the original 1997 model by Credit Suisse Financial Products. However the last decade has seen much research focusing on ways of relaxing these assumptions to provide greater accuracy without sacrificing the advantages of analytics.

While substantial progress has been made in this arena, many problems have remained and indeed many new questions have been raised in the wake of the credit crunch. In particular recent events have crystallised the need for a robust and accurate representation of extreme value risk.

As a response to these concerns, the Financial Engineering and Research (FERe) team within Misys Risk have developed cutting-edge pattern analysis techniques for the identification and quantification of extreme value risk and the sometimes complex relationships existing between them. Incorporation of these methods into our CHV framework not only allows one to measure portfolio effects of mar-

ket stresses and crises but also addresses key problems present even in the most advanced variants of CreditRisk[®].

As we illustrate, our model allows for a significantly greater degree of flexibility in the range of sector correlations that may be attained and, perhaps more notably, for the first time it is possible to capture negative correlations between sectors. Our approach also allows for conditioning of the obligor default probabilities on the most recent sector risk values, thereby addressing the “through-the-cycle” limitations of other vendor solutions.

By allowing for an explicit representation of the dependencies between extreme values within CHV the FERe team have paved the way for a model that captures the dynamic behaviour of extreme values and the manner in which they propagate through markets — namely contagion.

The State of Modelling

Those familiar with CreditRisk[®] will recall that the principal stochastic variable of interest is the obligor default probability. Thus, unlike other models, the random nature of probabilities themselves are directly and explicitly modelled.

In this setting default correlation structures can be achieved by allowing each obligor default to be dependent upon a common set of “sector risk factors”, whereby each obligor’s individual dependence is characterised by a set of sector weights specific to it.

By assuming each sector risk factor to be independent and Gamma distributed one may retain analytical expressions for default and loss distributions. Of course this is a crucial omission since in the real world sectors are not generally independent. More seriously it ignores the propensity of typically uncorrelated risk factors to display enhanced dependence in

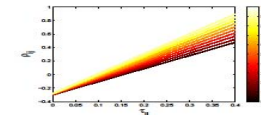


Figure 1: Model Correlation ρ_{ij} Vs r_{ij} and the Hidden Gamma Parameter α (colour coded). $\sigma_1 = \sigma_2 = 0.08$, skew(X_1) = -1.02, skew(X_2) = 1.2, kurtosis(X_1) = kurtosis(X_2) = 2.0. Variations of r_{ij} and α in the Gamma mixture + Hidden Gamma Model allows for a wide range of sector correlations. Note that negative correlations are possible.

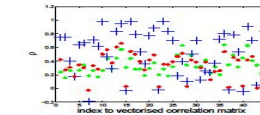


Figure 2: Correlations: Target (blue crosses) Vs Model (red dots) Gamma mixture + Hidden Gamma, green: Hidden Gamma only). Hidden Gamma shows poor relative heterogeneity in correlation structure compared to the Gamma mixture. Data: iTrace Equity Series 5, n = 10.

times of systemic crisis.

Various solutions to this problem have been offered, the most popular being the “Hidden Gamma” model, some of which permit a good range of sector correlations whilst retaining analyticity. Perhaps most importantly, all of the current models known to the authors match only the second moments of the sector distributions and as such are ignorant of the tails of the distribution — where extreme risk is located.

The Modelling of States

One might improve these models by admitting the possibility of structural shifts in market parameters so that sector factors are composed of a mixture of states representing risks in a peaceful state (e.g. small mean default probability and low volatility) and in a stressed/crisis state (e.g. high mean and high volatility).

By characterising each sector factor as a mixture of Gamma we may calibrate to higher order mo-

ments (skew, kurtosis etc.) of the sector distributions, thereby deriving the direction, magnitude and probability of extreme risks within empirical data.

Since the parameters of the Gamma mixture have been fitted to the empirical moments it remains to determine how the extreme movements relate to one another. Clearly this is an important issue since the credit implications of a systemic stress are likely to be very different to those where stresses are confined to an industry, geographic location or asset class etc.

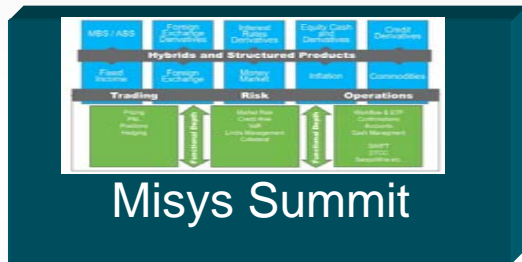
Unfortunately the question of determining the incidence of different stress states is a particularly difficult one. If each risk factor can occupy one of two states, then there exist four permutations of stress and peaceful states when considering two factors. Each additional factor doubles the number of possibilities, and so generalising to n-factors we see that there are 2^n potential stress-state combinations. Given for relatively low dimensional models as is typical in CreditRisk-type implementations one would have in excess of one million ($2^{20} = 1,048,576$) possibilities to estimate.

Being showcased separately today

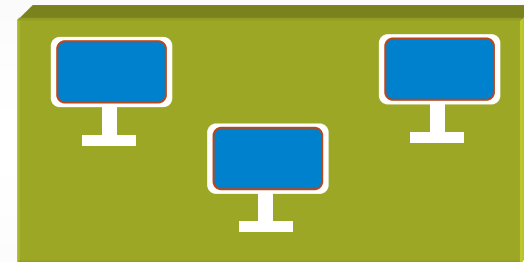
Enterprise Risk Framework (Risk Vision)



Misys System



Other Systems



Inter Operable Components

Credit Default Modelling using Misys Credit Risk Vantage		
Inputs	Outputs	Applications
Loss Given Default	Credit VaR	Credit VaR for Limit Mgmt
Mean Default Rate	Expected Shortfall	Credit Portfolio Mgmt
Default Rate Volatility	Complete Credit Loss Distribution	Credit Economic Capital
Sectors and Sector Weights	Credit VaR contribution of individual obligors	Credit Stress Testing & Scenario Analysis
Misys Credit Risk Vantage Component Structure		
Data Integration	Calculator Engine	Results Management
<small>Solves Basel II RBC (cash-by-cash approval) Input to Risk-Return measures like RAROC</small>		

Credit Risk Vantage

Dashboards

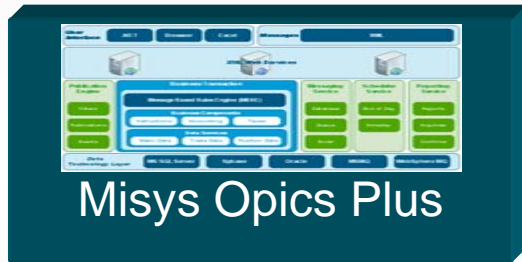
Sample client risk environment
 Misys provides expertise at all levels



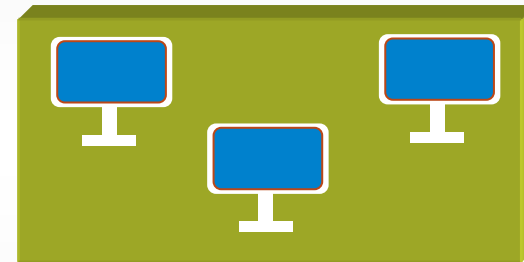
Enterprise Risk Framework (Risk Vision)



Misys System



Other Systems



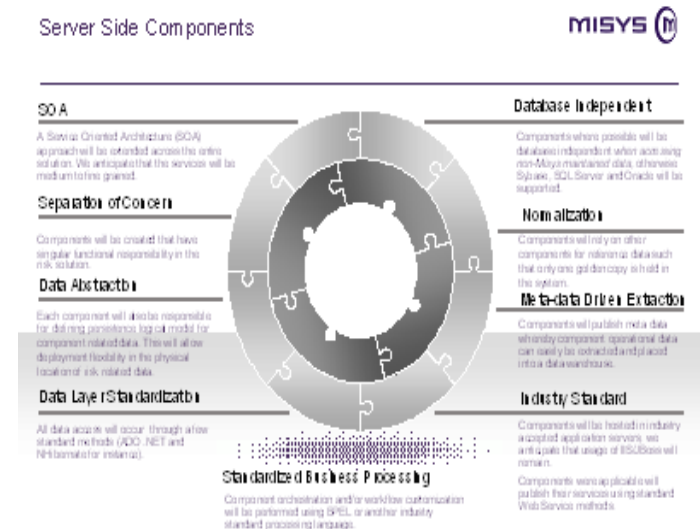
Inter Operable Components

Credit Risk Vantage

Credit Default Modelling using Misys Credit Risk Vantage		
Inputs	Outputs	Applications
Loss Given Default	Credit VaR	Credit VaR for Limit Mgmt
Mean Default Rate	Expected Shortfall	Credit Portfolio Mgmt
Default Rate Volatility	Complete Credit Loss Distribution	Credit Economic Capital
Sectors and Sector Weights	Credit VaR contribution of individual obligors	Credit Stress Testing & Scenario Analysis
Misys Credit Risk Vantage Component Structure		
Input	Calculation Engine	Results Management
Solves Basel II RBC (cash-by-cash approval) Input to Risk Return measures like RAROC		

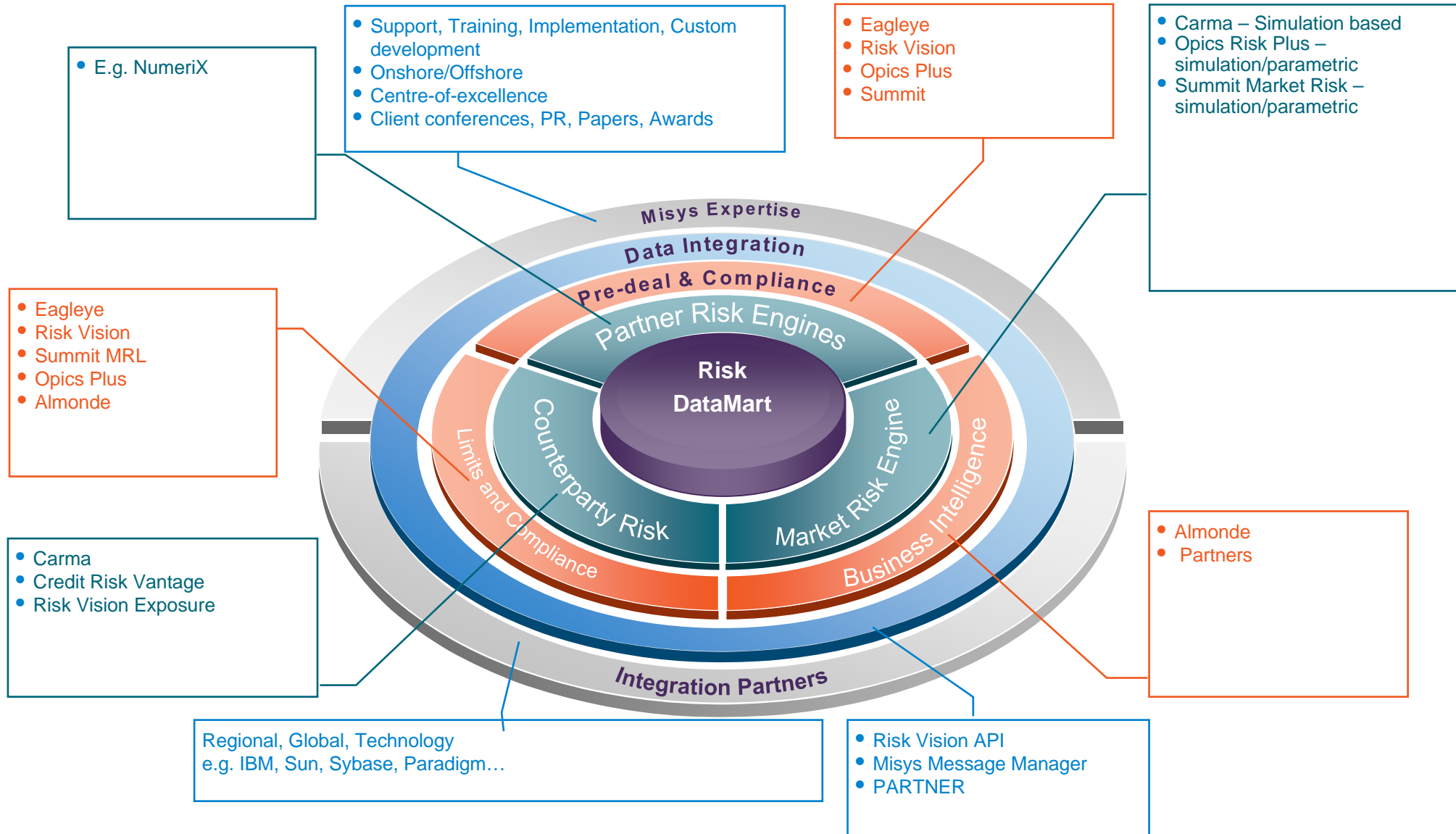
Dashboards

- Risk is clearly important to all clients and to our business
- We continue to advance our individual solutions – sometimes faster and easier
 - MRL in Summit
 - Portfolio Optimisation in Opics Risk Plus
 - Proactive monitoring in Eagleye
 - Renewed UI, easier to use in Risk Vision
 - ...
- We continuing to build and deliver new interoperable components
 - ‘build once’ and use across all other products
 - Sample component Credit Risk Vantage
- We continuing to provide a single high performance global data repository through Risk Vision for ERM
 - Consistent, clean, timely, with high performance
- Existing clients will continue to receive advanced, practical and easier to use solutions from Misys, to provide use at Department and Enterprise levels



The Misys Risk Framework and Components

Expertise, Services and Solutions





experience, solutions, results