Deutsche Bank
Global Technology and Operations

Operational and Computational Challenges in Counterparty Credit Risk

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Passion to Perform

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Agenda

1	About Deutsche Bank
2	Regulatory and Market Changes since the 2008 Crisis
3	Technology and Operational Challenges
4	Integrated Architecture Framework
5	Summary and Conclusions

About Deutsche Bank

- Global Universal Bank with in excess of EUR 1.6 tn of assets

- Over 98,000 full time staff, with over half of them outside Germany

- Corporate Banking & Securities (CB&S) represents the core investment banking division and the individual product lines are supported by the Credit Portfolio Strategies Group (CPSG) which actively manages certain uncollateralised derivatives exposure

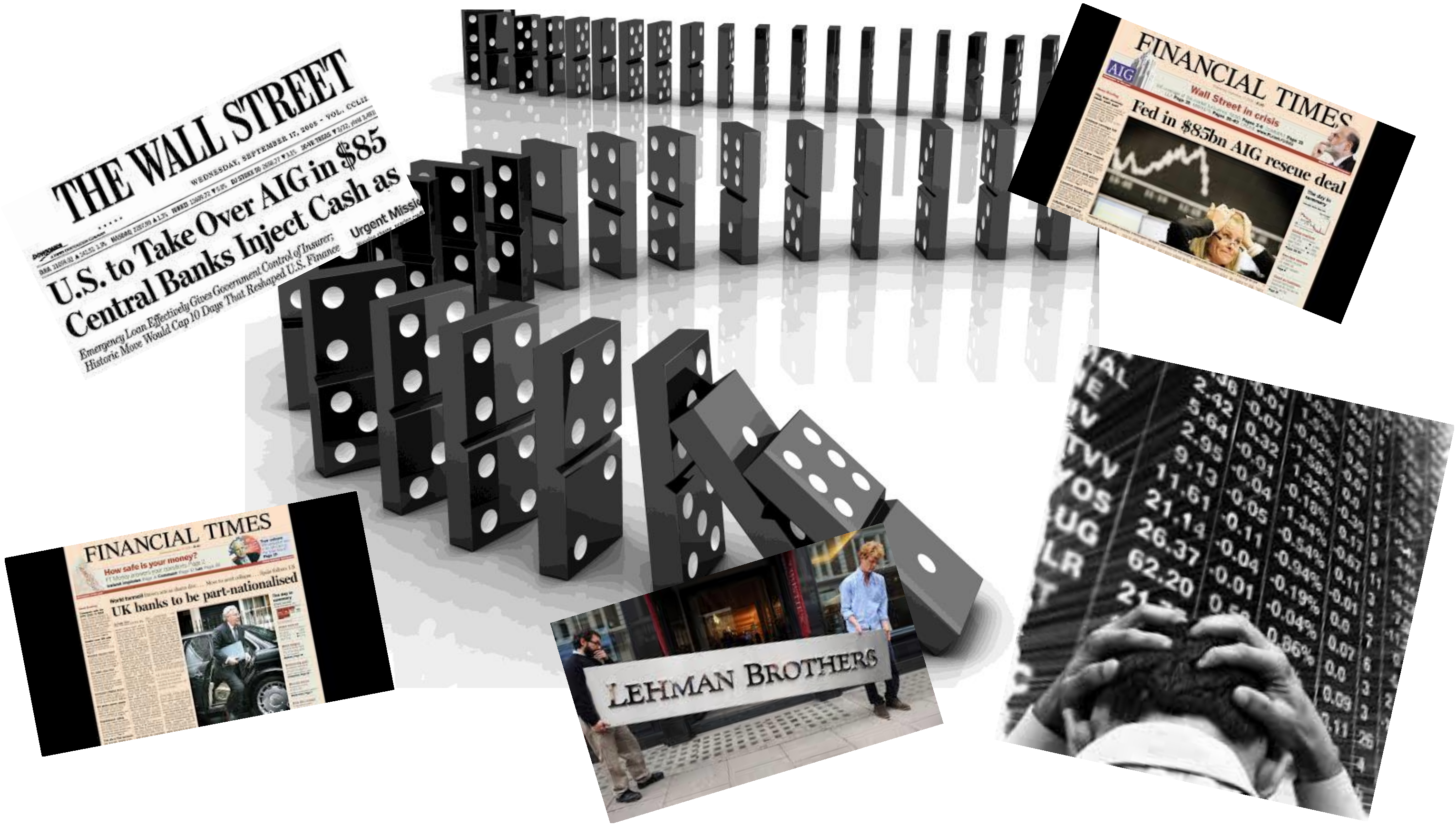
- Recent awards: “Bank Risk Manager of the Year”, “Single Dealer Platform of the Year” and “Interest Rate Derivatives House of the Year” (Risk Magazine, 2015 Risk Awards)

Counterparty Risk Technology at Deutsche Bank

- Cross-margining for FICC and Equities, supporting award winning equity prime finance and securities lending services
- *x*VA Pricing
- IFRS CVA and CVA RWA hedging
- Regulatory margining for uncleared OTC derivatives
- Limit monitoring for electronic trading execution and real time margining, limit-checking over 2 million trades and processing a billion price quotes per trading day

Agenda

2008 – A Financial System on the Brink of Collapse



Following the crisis, Counterparty and Funding Risk has become a key Front Office responsibility, impacting client pricing and ability to maintain market share without increasing capital cost.

Regulatory Changes

- Increased focus on systemic risk
    - Increased equity capital requirements
    - Mandatory clearing
    - Initial margin for uncleared OTC products
    - Increased focus on enforcement

- Further divergence in regulation for large broker/dealers vs. smaller financials and non-financial hedgers, with stricter rules for larger firms

- Banks required to measure and reserve all risks, even if previously not considered material, e.g.
    - Margin Period of Risk
    - Wrong Way Risk
    - Clearing Default
    - Listed Derivatives Client Exposures

Market Structure Changes

- Counterparty and funding risk (“xVA”) being priced into the bid/offer
- Margining arrangements and portfolio cross-margining impacts client willingness and ability to trade under tighter capital constraints
- Revenue per trade continues to decrease with a trend to standardised products, electronic trading and clearing. Accurate measurement of counterparty risk and collateral cost critical to understanding profitability of trades and client relationships
- Market fragmentation through competing clearing houses, SEFs, and clearing exemptions require real-time impact analysis to make informed venue decision

Counterparty Risk and Funding are Connected

Higher collateralisation reduces counterparty risk, but increases funding cost and funding risk. Understanding collateralisation (type of collateral, frequency of payment, payment threshold) is critical. For derivatives, this is captured in the CSA (Credit Support Annex) to the ISDA Master Agreement.

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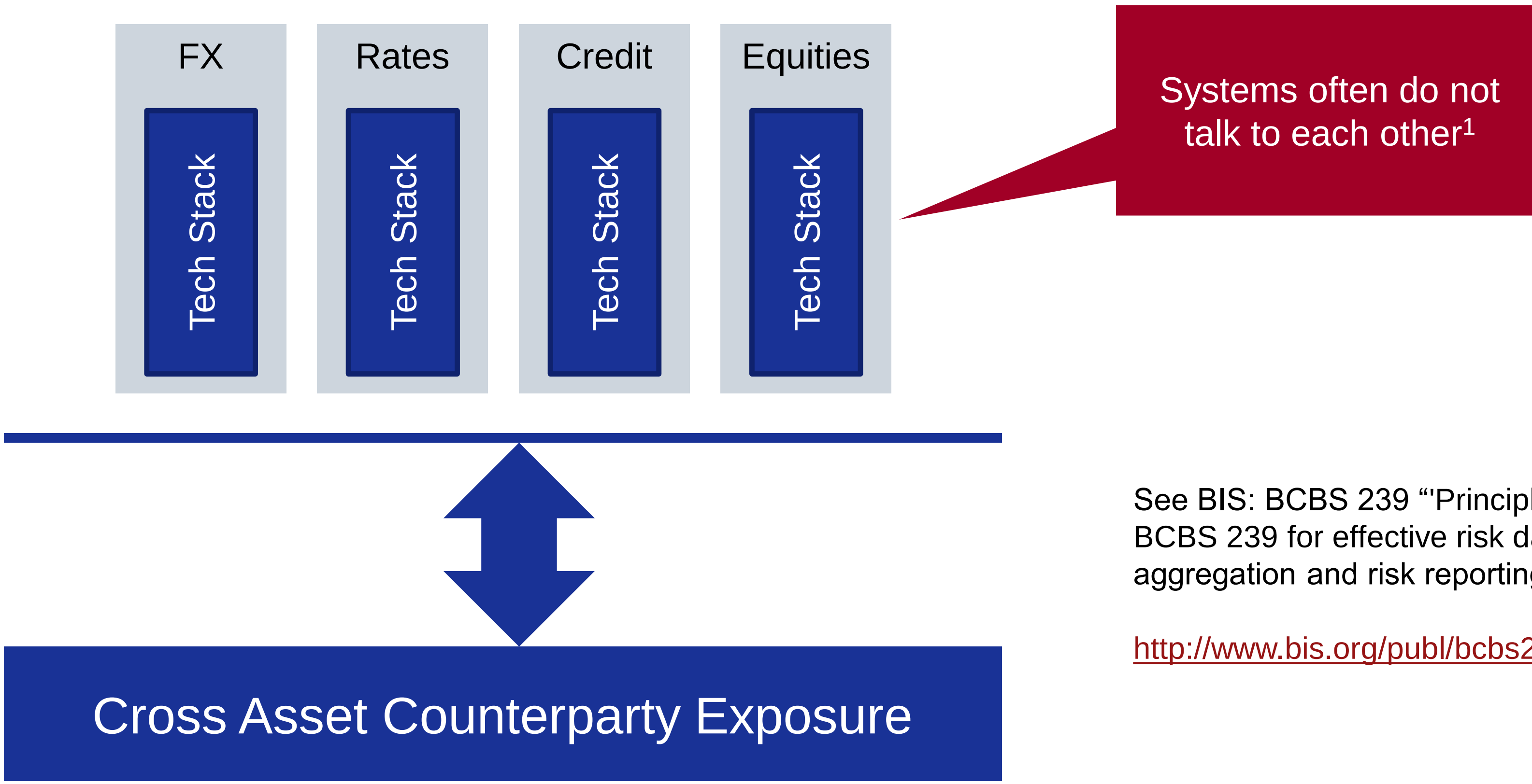
Lack of Integration across Technology and Business Silos

Counterparty risk is inherently cross asset class and is impacted by traditional business line silos.



See BIS: BCBS 239 "'Principles in BCBS 239 for effective risk data aggregation and risk reporting"

http://www.bis.org/publ/bcbs239.htm

[1] Source: BankingTech journal (http://bit.ly/1ui5PWo)

Client and Legal Entity Reference Data Quality

- Lack of shared “golden source” data – Reference data used by different risk systems are often managed locally and are inconsistent between systems, leading to inconsistent risk or limit calculation[1]
- Details of CSA agreements or netting agreements often not captured correctly in IT systems. Details which do not normally affect daily collateral management (collateral optionality, downgrade triggers, or thresholds) may exist in the signed (paper) document but not feeding pricing and risk calculations[2]
- Legal Entity (LE) information not complete or incorrect; prior to DVA calculation and CRD IV Leverage ratio calculation incorrect LE had less consequence[3]

[1] Source: Reuters (http://reut.rs/1ui70oJ)
[2] Source: WallStreet Systems (http://ubm.io/15qwbPX)
[3] Source: Banque de France (http://bit.ly/1J1KO9g)

Front Office Requirements Differ From Credit Control Requirements

Credit Control Requirements	Front Office Capability Requirements
• T+*n* calculation, for some only monthly calculation	• Real-time, pre-deal limit checking requirement (sub-millisecond for electronic trading) • Ability for sales/trading to quote xVA charges real-time at the point of trading
• Approximation of Front Office pricing models appropriate. Model discrepancies can be handled through “conservative approach” to exposure	• Accurate pricing critical: if risk is priced too high, client will not trade. If risk is priced too low, the trade will not be profitable. • Incorrect pricing of xVA results in incorrect hedging
• Regulatory model control	• Front Office managed model and calibration (calibrated to market)

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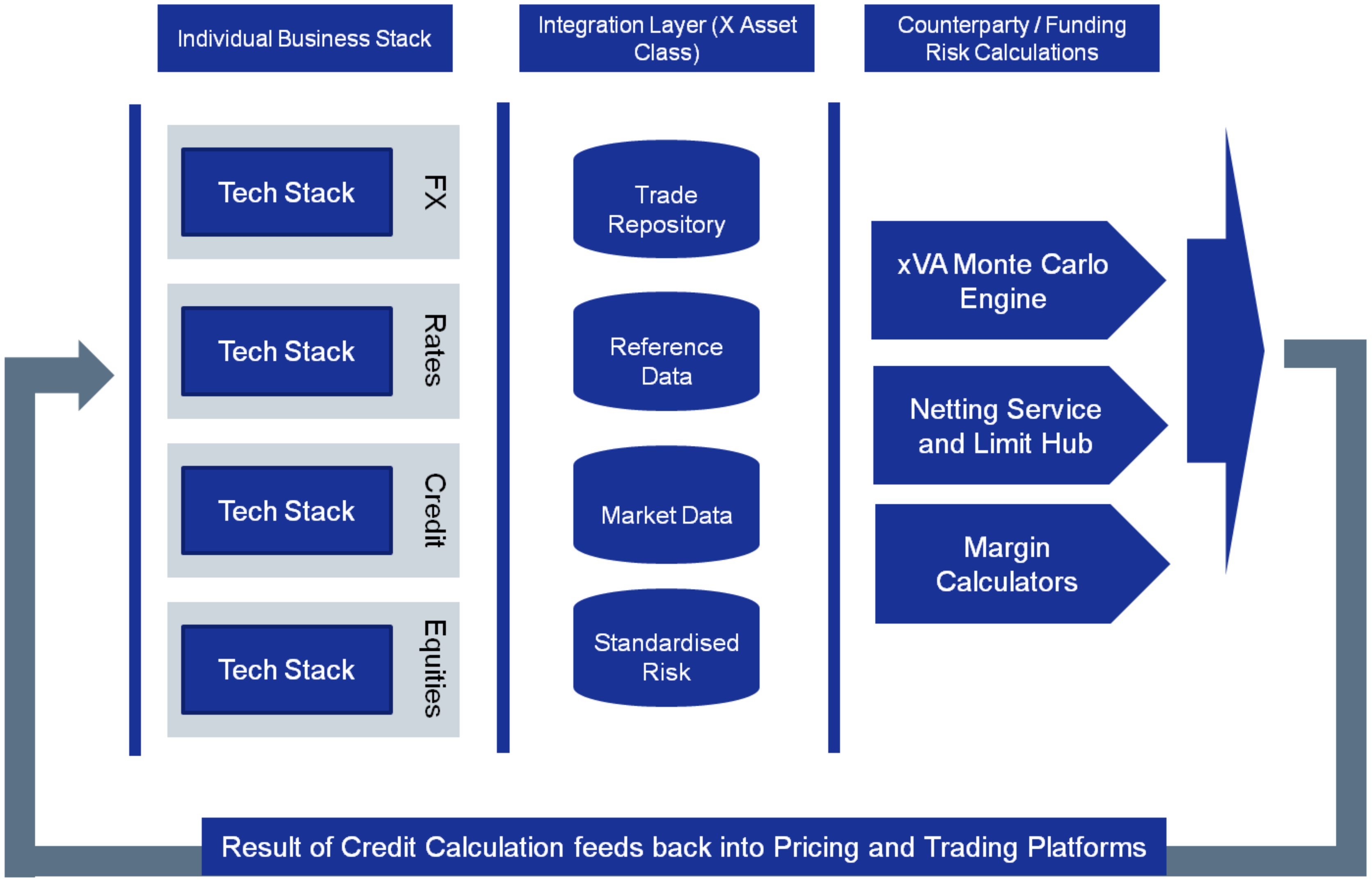
Architectural Framework for Integrated Counterparty and Funding Risk Technology



Focus on Data Quality and Data Governance

- Ensure incorrect reference data are fixed at source and not in additional “processing” layers

- Engage business owners of data – quality of data is not just an operational or technology problem

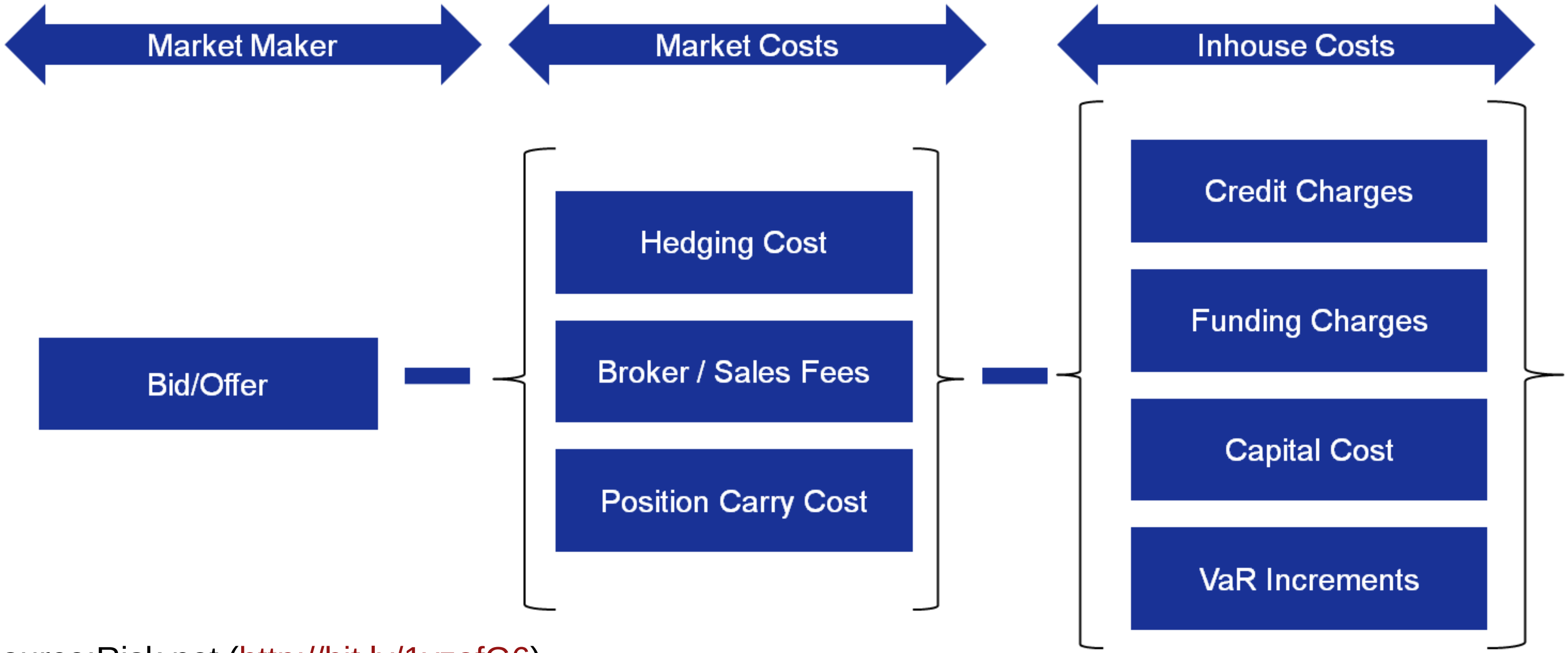
- Explore data management solution for traditional paper based contracts (OCR technology) for additional quality control

- Use regulatory demands (Dodd-Frank, Volcker, EMIR) as advantage – leverage the investment into cross asset class regulatory demands to achieve better quality enterprise data

Increase Trading Revenue by Integrating Counterparty and Funding Risk Into Pricing

- Cost of credit, funding and capital impact profitability of trades[1]

- By integrating full costs into the pricing and trading platform, sales and trading are able to make immediate decisions on the profitability of a transaction



[1] Source:Risk.net (http://bit.ly/1yzofG6)

Industry-wide Solutions And Vendor Options

- Margining for uncleared OTC – potential industry-wide solutions are still under discussion

- Vendors of xVA calculation will continue to emerge and will be attractive for banks with no dedicated CVA hedging desk (For example, TriOptima's "TriCalculate" service)

- Clearing houses naturally provide central risk and margin for derivatives users, however represent additional risks for clearing members

- Large derivatives traders will however be required to be able to calculate risk independently, even if external calculations are available.

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Summary & Conclusions

- Management of counterparty and funding risk has become a trading desk responsibility

- Revenues per trade continue to shrink – reduced bid/offer spreads, reduced trading size – making accurate pricing of credit, funding and capital cost critical

- Technology and Operational alignment is critical, but requires a step-change for many organisations

- The ability to meet technology challenges will be a competitive differentiator for large broker/dealers and will impact the trading and hedging costs of every market participant

Q & A