Measuring the Impact of Transactional Data Quality On Operational Risk and Capital Adequacy For Global Investment Banks

Chito Jovellanos
forward look, inc.
chito@forwardlook.com

Executive Summary : This presentation describes the application of data quality management in global securities trading to forecast the probability of transaction failures and the impact on operating capital requirements. The key observations are (a) data standardization is necessary but insufficient; and (b) the primary determinant of straight-through-processing (STP) for electronic transactions is the effectiveness of mediation across non-stationary message contexts between the counterparties.

1

Objectives of this presentation

➢ Provide **examples for the research community on Information Quality (IQ) applications**

➢ Encourage **more work in the securities trading domain**

➢ Critique **forward look, inc.'s approach and solution**

Concepts

Background
- *International Investment Banking*
- *Automation & STP*

International Investment Banks : What They Do

➢ **Capitalize acquisition & sale of companies**

➢ **Place their own capital at risk (principals, not just agents)**

Automation and Straight-Through-Processing (STP)

➢ **Premium on 'hands-off' (exception-based) operations**

➢ **Transaction costs generate implementation shortfalls**

➢ **Implementation shortfalls depress investment returns and firm profitability**

Concepts

Background … cont
- *Operational Risk*
- *Contingent vs Regulatory Capital*

Operational Risk

> **Formally attributed to "people, process and systems"**

> **Incorporated into regulatory requirements (Basel II)** [1]

Contingent vs Regulatory Capital

> **Contingent : Funds high-probability, low-impact events**
> **(eg, trading losses; bad customer debt)**

> **Regulatory : Funds low-probability, high-impact events**
> **(eg, Basel II & counterparty 'loss given default')**

Problem

Failed Securities Trades
- *costly to fix*
- *capital inefficient*

Definition of a failed trade

> **Securities and cash not exchanged on settlement date**

> **Settlement date convention : Trade Date + 3 ('T+3')**

Across Securities Industry Participants (Institutional, not Retail)

> **Financial Impact : USD 12B per annum (in 2005)** [4]

> **Primary Causes : transaction processing errors**

Top 10 Global Banks & Investment Firms (by 2008)

> **Basel II Regulatory Capital Impact : ↑ ~   4%**

> **Contingent Capital Requirements : ↑ ~ 10%**

Remedy ?

Standardization

- across counterparties
- for shared workflows

New Problem : EVERYONE wanted to set THE standard

- ➢ **Brokers : SSAB, FIX**
- ➢ **Banks   : ISO15022, ISITC**
- ➢ **Vendors : (something) ML**

Messaging Standards : Industry-Wide Convergence

- ➢ **Brokers   FIX   98%**
     FpML   87%
- ➢ **Banks   ISO 15022   96%**
- ➢ **Over 15+ years needed to assimilate institutionally (ie, standardization efforts began in 1989 through to today)**

Next Problem

Interoperability Failures
- *within a standards-based protocol*
- *across compliant counterparty messages*

Symptom

➢ **Fails 'plateau' at ~10% (US), 20-30% (international) despite active adherence to standards !**

Root Causes

➢ **Message Structure : Flat vs Hierarchical - eg, ISO vs XML**

➢ **Semantic Gaps   : key drivers are**

■ Reference Data Use - eg, Standing Settlement Instructions; Coding Schemes [2]

■ Non-Stationary Business Contexts (due primarily to product evolution; workflow adjustments between counterparties incorporated into the standards; regulatory impacts)

Solution [3]

> ## 1. Interoperability Metrics
> - *near-time transaction monitoring*
> - *syntactic and semantic gap analysis*

Monitor Transaction Data Streams

  ➢ **Inbound and Outbound Between Counterparties (near-time)**

Measure Data Mediation Burden

  ➢ **Syntactic Gap + Semantic Gap + "α"**

   Msg Structure + Data Values   +   Past Performance

Key Metric   : Data Operability Threshold (DOT)

  ➢ **Signals probability of a state change from STP to non-STP**

Solution

2. Mediation Enablers
- *Data Configuration Templates*
- *Data Interoperability Grid*
- *Data Operability Threshold*
- *Universal Data Structure*

Data Configuration Templates (DCT)
- ➤ **Repository of syntax rules and ontologies (workflow based)**
- ➤ **Establishes a bounded problem space**
- ➤ **Example : syntax rule : ISO15022 field 35B is mandatory**
- ➤ **Example : ontology   : ISO15022 message segment concepts**

Data Interoperability Grid (DIG)
- ➤ **Synthesizes similarity measures : both <u>syntax</u> and <u>semantics</u>**
- ➤ **Tracks changes that occur over <u>time</u>**
- ➤ **Example : relative frequency of tags and code value usage**

Solution

2. Mediation Enablers ... cont
- *Data Configuration Templates*
- *Data Interoperability Grid*
- ***Data Operability Threshold***
- ***Universal Data Structure***

Data Operability Threshold (DOT)

➢ **Probabilistic measure of the likelihood of STP**

➢ **Hierarchy of sensitivies : Counterparties > Markets > Securities**

➢ **Calculated from DIG metrics. Unique to counterparty workflow**

Universal Data Structures (UDS)

➢ **Executable data transformation rules**

➢ **Unique to counterparty workflow**

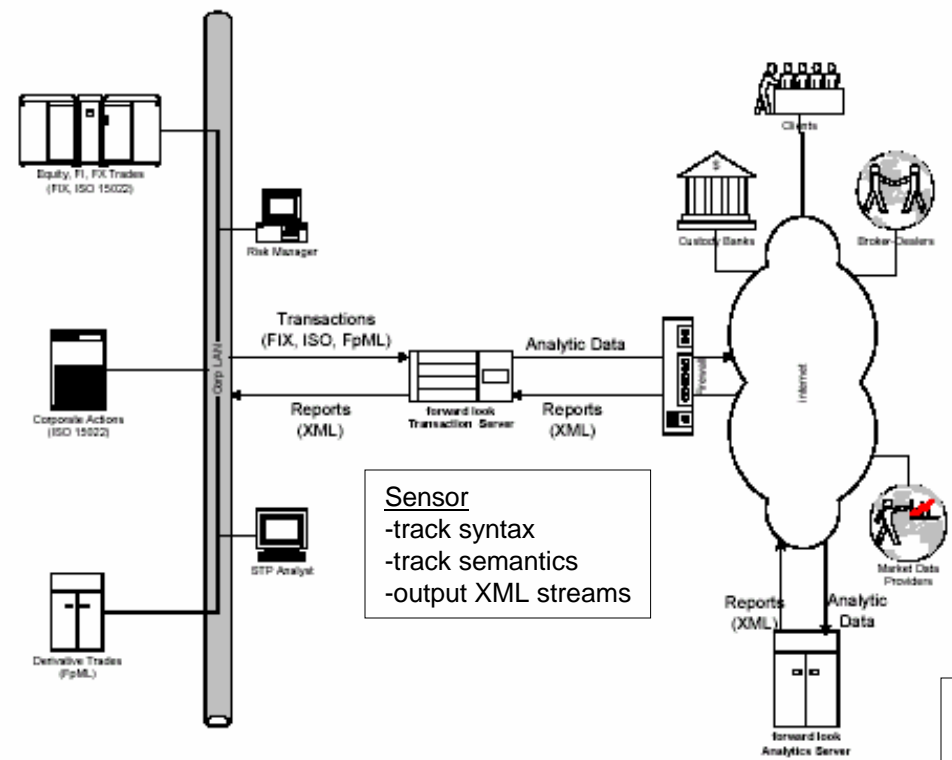➢ **Example : narrative field parsed into structured data fields**

Solution

Implementation Architecture
- *local "sensor" at the client*
- interoperability metrics calculated centrally

Client System
-listed securities
-corporate actions
-derivatives

Counterparties
-clients
-brokers
-banks
-data vendors
-exchanges

Sensor
-track syntax
-track semantics
-output XML streams

Interoperability Metrics
-diff's in syntax
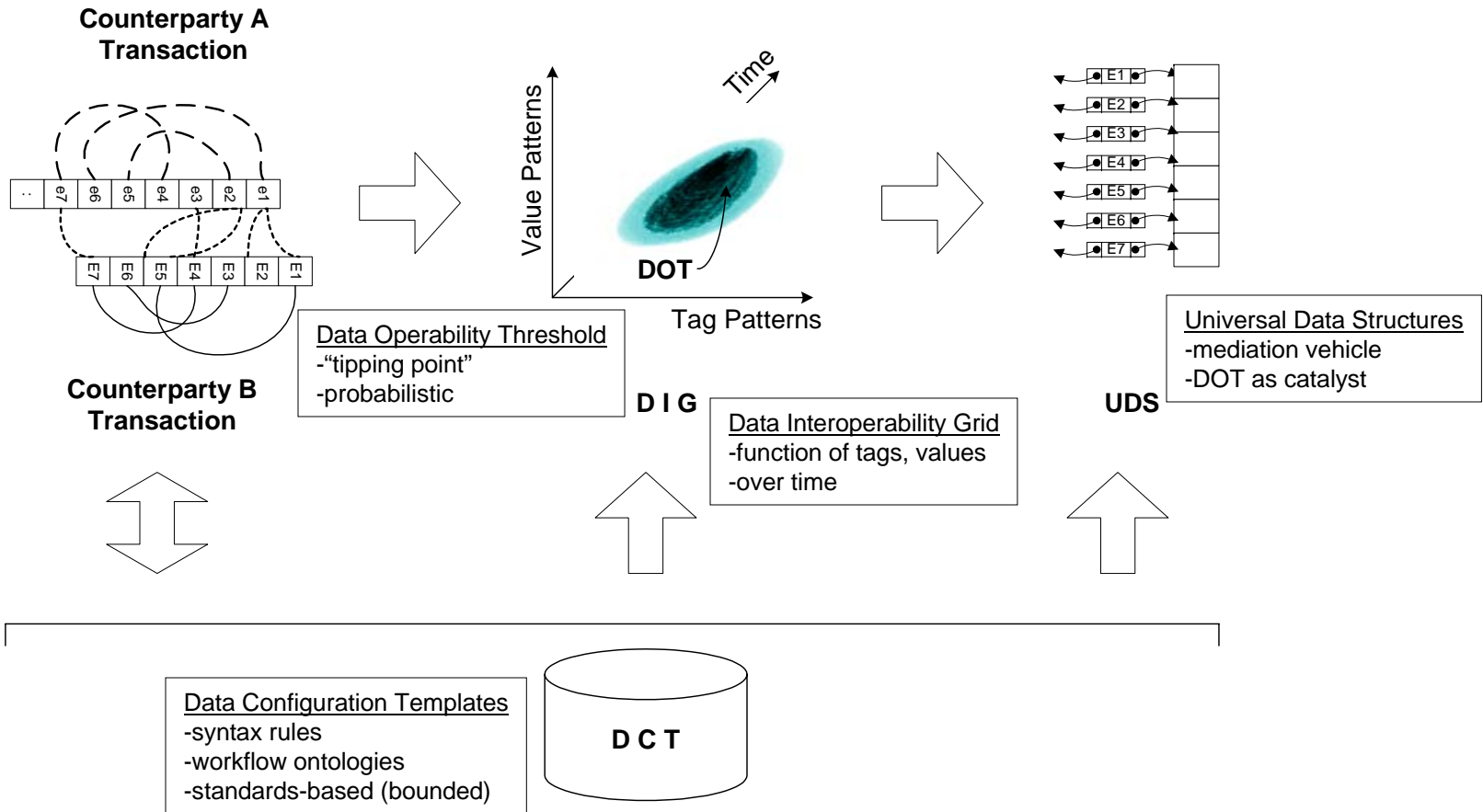-semantic gaps
-returns XML stream

Solution

Implementation Architecture ... cont
- *primary objects*
- *central concepts*

Transactions
-c'party perspectives
-per systems capability

**Counterparty A
Transaction**

**Counterparty B
Transaction**

Time

Value Patterns

DOT

Tag Patterns

E1
E2
E3
E4
E5
E6
E7

Data Operability Threshold
-"tipping point"
-probabilistic

D I G

Data Interoperability Grid
-function of tags, values
-over time

UDS

Universal Data Structures
-mediation vehicle
-DOT as catalyst

Data Configuration Templates
-syntax rules
-workflow ontologies
-standards-based (bounded)

D C T

12

Results

Predictive Capabilities to
- improve use of standards and enhance STP
- evaluate counterparty performance
- reduce contingent capital needs

OBJECTIVE	OUTCOMES
Improve Standards Usage	Significant STP improvement
Corporate Actions	64 → 98% (↑34%) STP Rates
Securities Settlement	86 → 99% (↑13%) STP Rates
Evaluate Counterparty Performance	Rank operational excellence
	Systems Quality : Neutral Factor Systems Congruence : Strong Effects
Reduce Capital Needs	Regulatory : 2% (~ ↓ USD 2 Billion) Contingent : 6% (~ ↓ USD 5 Billion)

Results

Improve Application of Standards
- account for sources of variation

UDS's enable data transformation to support compliant messaging

> **Some workflows are harder than others (eg, corporate actions vs 'vanilla' equity trades)**

Results

Evaluate Counterparty Performance
- know your 'dance partner'
- amplify their strengths
- compensate for their weaknesses

Establish ranking of counterparties based on historical capabilities

> **History, esp. recent history, is a reliable predictor of synergies with counterparties regarding electronic messaging**

Results

Contingent Capital Forecasting
- goal is to minimize unproductive capital
- ensure adequacy of protecting the downside
- comply with regulatory strictures

Secure pre-emptive contractual relief for operational risk at
significantly reduced costs from

- ➢ **Insurance (traditional)**
- ➢ **Capital markets : hedge & offset (emerging)**

Summary

Problem : Fails in Global Securities Trading

1. **Despite adherence to messaging standards**

2. **Expensive to repair - time & contingent capital**

3. **Costly - regulatory capital impact**

Solution : Interoperability Metrics + Mediation

1. **Profile message structure**

2. **Profile semantic gap**

3. **Track Data Operability Threshold per counterparty**

Results

1. **Insight into message structure and fails**

2. **Forecast operational risk and capital burden**

3. **Highlight mediation quality as central to STP**

Further work

1. **What's next?**

Further Work

Next Steps
- *improve platform operability*
- *develop better algorithms*

→ **Need To Reduce Training Time**

- Currently ~17 h for 100,000 messages
- Processing times sensitive to :
  - ❖ Complex messages (highly nested, linked structures)
  - ❖ Syntax transitions (periodic message standard upgrades)
  - ❖ Management of outliers

→ **How to Handle Very Large Data Streams**

- > 400,000 transactions per day (~75,000 'burst' rate)
- 'Sampling window' selection
- Cumulative metrics

References

[1] Basel Committee on Banking Supervision. Results of the fifth quantitative impact study (QIS 5). 16 June 2006. 61 p.

[2] Grody A, Harmantzis F and Kaple G. Operational Risk and Reference Data. Financial InterGroup Research Paper, Nov 2005. 88 p.

[3] Jovellanos C.   ContextMetrics™ :Semantic and Syntactic Interoperability in Cross-Border Trading Systems. 20th International Conference on Data Engineering (ICDE '04 - April 2004). p 808

[4] Society for World-Wide Interbank Financial Telecommunications. Annual Report, 2002.