High Volume Low Latency Transaction Processing

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Contents

- Overview of LiquidityHub
- Key challenges
- Technology overview
- Outcome
- Lessons learned
Overview

- Current Situation
  - Interest Rate Swaps
  - Manual process
  - Multiple sources
  - Trading mechanism risk on dealer
Overview II

- Current Market Environment
  - Introducing change in a volatile environment
  - Change vs. execution confidence

'Market can find solution to sub prime debt crisis'

Credit crunch hits high street

volatile markets...
Overview III

- LiquidityHub Vision
  - Build platform that enables access to multiple sources
  - Leverage existing distribution channels
  - Platform must scale to include future products
  - Offer Request for Stream with real time pricing
  - More transparency, better pricing
  - Enable STP, reduce costs
Overview IV

Liquidity Hub

Market Data Distributor

Dealers

Streamed Pricing

Composite Prices

RFS Session

Liquidity Hub

Access permissions
Trade negotiation
messages

Composite Prices

RFS Session

Distributors

Bloomberg

Clients

Swapswire

Trade Detail

Trade confirm

Trade Detail

Client Confidential
Key Challenges

- **Performance**
  - Trade negotiation is time-sensitive, < 100 ms latency required
  - Year one volume 20,000 msg/s scaling to 100,000 msg/s by year five.

- **Reliability**
  - No loss of trade messages / transactions

- **Ease Of Integration**
  - Dealers and Distributors

- **Availability**
  - 99.99%

- **Time To Market**
  - Go Live Sept 2007 (9 months!)
Key Challenges - Implementation

- Technology partner needed to define and implement the solution:
  - Detica had a global team with a track record implementing high volume low latency systems
  - Event Driven & Real Time Architecture expertise
  - Dedicated Market Services business area
  - Combined business and technology capability
Technology – Functional Overview
Technology – Pricing Example

Gateway Tier
- Quote Gateway
- Trade Gateway
- Market Data Gateway

Middleware Tier
- Middleware Server
- Middleware Server

Application Tier
- Trade Services
- Admin Services
- Pricing Services
- Reporting Services

Data Tier
- Database

Dealers (INVESTMENT BANKS)
- Distributors (REUTERS & BBG)

Market Data (Composite Price)
Technology - Products

Gateway Tier
- Cameron US
- BEA WLRT
- Trade Gateway
- Cameron MDS
- BEA WLRT

Middleware Tier
- Fiorano JMS
- BEA WLRT
- Fiorano JMS
- BEA WLRT

Application Tier
- Spring
- BEA WLRT
- Spring
- BEA WLRT
- Spring
- BEA WLRT
- Spring
- BEA WLRT

Data Tier
- Oracle RAC
Technology – Hardware

Cameron US/MDS FIX WLRT
Trade & Quote Gateway
Market Data Gateway
FioranoMQ WLRT
Middleware

Spring WLRT
Trade Services
Pricing Services
Admin Services
Reporting Services

Oracle RAC
Op/Trade Databases
Tick/Reporting Databases

Key
HP DL360
- Dual Core 2xCPU 3GHz
- 4GB RAM

HP DL580
- Dual Core 4xCPU 3.4GHz
- 8GB RAM

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Technology – Product Performance

- Cameron Universal Server & Market Data Server
  - FIX Servers
    - FIX is a standard communications protocol within the Investment Banking domain but is flexible enough to be customised
    - Cameron US/MDS can handle > 25,000 msg/s

- Fiorano MQ
  - Pure JMS Server
  - Can handle > 80,000 non-persistent msg/s
Technology – Product Performance

- WebLogic Real Time provided a huge performance improvement compared to standard Sun JVM
  - **With** -15ms latency
  - **Without** - significantly > 100ms latency
- Underpinned key components in each tier
  - FIX Gateway Servers
  - JMS Servers
  - Spring
- Made Java solution a feasible and good choice for this system.
- System handling ~ 25,000 msg/s with 95th percentile latency ~15ms
Performance Monitoring

- JMX Monitoring Framework

Gateway Tier
- Quote Gateway
- Trade Gateway
- Market Data Gateway

Middleware Tier
- Middleware Server
- Middleware Server

Application Tier
- Trade Services MBean
- Admin Services MBean
- Reporting Services MBean
- Pricing Services MBean

Data Tier
- Database
Performance Monitoring

- Administration Application provides detailed statistics on:
  - Latency
    - Per message type
    - Per component if required
  - Throughput
  - Server/Service Status
- Provides an easily understandable dashboard for LiquidityHub staff.
Outcome

- Designed, built and delivered the system in 9 months.
- System meets year 1 peak performance targets
  - Current latency figures 4 – 8ms
- System can scale to much higher message volumes
- Phase 4 currently in progress
Lessons Learned

- Create more testing tools
  - Distributor GUI test harness
  - Log search & view
- Early prototyping helped de-risk the architecture
- Consider virtualization
- Managing 17 organisations is not easy!
  - Weekly tech forums worked well
Questions?

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