Best Practices in Technical Architectures for Fixed Income Market Participants

Dr. Jean-Claude Franchitti
Presentation Agenda

• Observations of a Former Trader
• Fixed Income Technical Architectures
  – Architecture Development Methodology
  – Fixed Income Business Process Maps
  – Fixed Income Solution Capabilities Matrix
  – Deriving a Conceptual Technology Vision
  – From the Conceptual Technology Vision to a Logical Infrastructure
  – From the Logical Infrastructure to a Physical Solution
  – Physical Solution Implementation Steps
• Conclusion
Observations of a Former Trader
Trading Environment Characteristics

- Anonymity
- Liquidity
- Transparency
Brokers’ Broker
Were They Efficient?

- Human factor
- Limited network of contacts
- Largest firms control the inventory
- Regional broker/dealers not well serviced
- Difficult to unwind odd-lot positions
- Phantom trades
- Buy-side firms are not a part of the equation
Where Are We Now?
Automated Trading Systems (ATS)

- Eliminates the Human Factor
- Buy-side is involved
- More regional bank and foreign institution participation
- Internet – A border-less enterprise

All of which creates better Liquidity and more Transparency in an Anonymous environment.
Six Drivers for Change

• Institutional and Retail customers
• Brick and mortar sell-side institutions
• Traditional buy-side firms
• Broker’s brokers
• Regulatory
• Entrepreneurs
Challenges

• Existing legacy systems and newer ATS’s will need to handle anticipated increases in trade volume implied by the development of STP.

• Fixed Income securities can have complex structures. Trading systems will need to incorporate proper analytics to calculate various essential data.

• There are many types of Fixed Income securities which trade in different ways. Standardized trading methodologies will need to be applied.

• Security information repositories will need to be large enough to hold data on millions of securities.

• Present front-end interfaces are no more than client/server versions of legacy systems.

• Back-office systems are antiquated. It may not be feasible to integrate them if they cannot support the new economy business.

• The new Fixed Income market of tomorrow may require an Application Program Interface (API) to a single Fixed Income exchange.

• T+1 must be incorporated into new technology.
Architecture Development Methodology
The eHub Securities Framework

Personal Blotter and Services

Client Sites

Direct systems interfaces

Browser/streaming interface

Distributed Hubs

Message Handlers

Adapters, connectors,
Message brokers, linkages
Distributed rules processors

Portal and Service Interfaces

Trading and Order Management

Order and NOE Rules and Routing

Verifications
Validation
Rules Execution

Service Manager

Verification
Validation
Rules Execution

Price Manager

Price Subscriptions
Personalization Rules

Valuations and Market data feeds

Execution Engines

Distributed rules processors

Processing Centers

Continuous Net Settlement Systems
Clearing and Settlement Rules Execution

Ledger Operations
Portfolio, Trust, Asset Ledger Rules

Information Engines
Risk, Forecast CRM, Budgets and Rules

Security Master
Transfer Agency, Custody Rules Assets/Institutions/Prices

The eHub
Mapping Vision to Solution

Vision and Objectives

Process Model

Solution Architecture
### Fulfilling the Objectives to Support the Vision

#### WORK STREAMS

<table>
<thead>
<tr>
<th>Customer facing</th>
<th>IT analysis and design</th>
<th>Business processes</th>
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<tbody>
<tr>
<td>Interviews</td>
<td>Current IT state assessment</td>
<td>Current business process assessment</td>
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<tr>
<td>Demographic research</td>
<td>Architecture design/collaboration</td>
<td>Operating model design/ collaboration</td>
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<tr>
<th>Competitive analysis</th>
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<tr>
<td>Regional competitive assessment (including Web site evaluation)</td>
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<td>Demographic research</td>
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<tr>
<th>Regulatory analysis</th>
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<tr>
<td>Deal structure assessment</td>
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<tr>
<td>Regional regulatory analysis for operating model</td>
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<thead>
<tr>
<th>Accounting and fiscal analysis</th>
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<tbody>
<tr>
<td>Tax assessment</td>
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<tr>
<td>Global analysis of tax implications for operating model</td>
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<tr>
<th>Business case</th>
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<tr>
<td>Documentation of revenue and cost driver</td>
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<td>Financial model development</td>
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<tr>
<th>JV and partnership analysis</th>
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<tr>
<td>Document findings from due diligence conversations</td>
</tr>
<tr>
<td>Develop general terms and conditions of JV/partnership</td>
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<tr>
<th>Go-to-market strategy</th>
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<tr>
<td>Document integration plan for all work streams</td>
</tr>
<tr>
<td>Strategic plan</td>
</tr>
</tbody>
</table>

#### OUTPUT

- Preliminary Future State Model
- Preliminary IT Architecture Design
- Preliminary Business Process Design

#### FUTURE STATE REALIZATION PROCESS

1. **Extraction of Capabilities**
2. **Refinements**
3. **Constraints**
4. **Validation**
5. **Final Future State Model**
   - Future State IT Architecture Design
   - Future State Business Process Design

The process involves iterative refinement and validation to achieve the final future state model.
For every 1M visitors, 40% don't return due to incomplete content; lost cost of their lifetime value is $2.8M – $1.5M - $2.1M wasted on site redesigns that don't fix the right problem.

Right to Left Thinking...

Architecture Development Map

As information is collected, work effort, estimates and solution becomes concrete.
Architecture Design Approach

Object-Oriented Analysis and Design
• UML models and diagrams

Design Assumptions
• Architectural capabilities are based on a limited set of business and technical requirements
• Simplicity, elegance, intelligibility, well-defined levels of abstraction, and clear separation between interface and implementation at all levels

Architecture Object Model
• Application architecture model
• Application infrastructure
  – Application Framework
• Technology infrastructure model
  – Physical architecture instance(s)
“4+1” Architecture View Model
“4+1” Architecture View Model

Describes the Architectural Vision
Model helps represent the various constraints on the architecture
Provides multiple perspectives to represent the system
  • Logical view
    – Static and dynamic aspects
  • Implementation view
    – Organization of modules within the development environment
  • Process view
    – Decomposition in terms of execution flows, and flow synchronization
  • Deployment view
    – Describes hardware resources and associated software deployment
  • Use case view
    – Motivates and justifies the architectural choices (i.e., “the glue”)
Application Architecture Overview

Enterprise Application Suite

• Channels
  – Web Portal
    • Web Interface
      – Web View
      – Web Controller

• Enterprise Services
  – Application Enterprise Services
    • Business Controller
      – Client Interface
      – Client Handler
      – Component Manager

• Business Object Model
• Infrastructure
  – Services
  – Common Facilities
  – Domain Specific Facilities
Architecture Design Summary

Driving Forces:

- Functional Requirements document
- Internal design guidelines
- Technology Preferences
- Software Architecture = Elements + Patterns + Motivations
- “4 + 1” View Model
- Model View Controller (MVC) Concept
Fixed Income Business Process Hierarchies and Maps
Average Present Day Solution
Fixed Income Trading Process Map

Client

Submits Order

"Not a valid order"

Validate Order at Sales Desk

Valid

Sales Desk Calls Client

Record Order

Yes

Update customer account

Electronic Execution?

Yes

Electronic submission execution

No

Route to Trading Desk

Non Automated Execution

Search

Front/Back Office

OTC Market

Client Places Order

"Electronic pass through?"

Monitor Execution

Confirmation Mailed to the customer

NO

Approved

Valid

Electronic submission execution

No

Route to Trading Desk

Non Automated Execution

Search

Electronic Execution?

Yes

Electronic submission execution

No

Route to Trading Desk

Non Automated Execution

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Electronic Execution?

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Electronic submission execution

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Route to Trading Desk

Non Automated Execution

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Electronic submission execution

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Electronic submission execution

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Electronic Execution?

Yes

Electronic submission execution

No

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Electronic submission execution

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Electronic submission execution

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Route to Trading Desk

Non Automated Execution

Search

Electronic Execution?
Sample Target Business Process Hierarchy

Sales / Marketing
- Customer Acquisition
- Product Determination
- Product Promotion
- Campaign Strategy

Order Room
- Place Orders
- Reconciliation
- Confirm GTC Orders
- Organize Pending Orders

Purchase & Sales
- Clearing & Settlement
- Customer Confirmation
- Booking
- Figuration
- Recording

New Accounts
- Open Accounts
- Account Maintenance

Stock Record
- Account Numbering
- Audit
- Security Movements

Margin
- Account Maintenance
- Sales Support
- Clear Issuance of Checks
- Items Due
- Extensions
- Close Outs
- Delivery of Securities

Accounting
- Bookkeeping
- Daily Cash Record
- Adjusted Trial Balance
- Profit & Loss Statement
- Trial Balance
- Establish Accounts

Proxy & Capital Reorg
- Proxy Voting
- Annual Reports, etc.

Cash / Securities Inventory
- Receive & Deliver
- Bank Loan
- Vaulting
- Stock Loan/Borrow
- Transfer
- Reorganization

Dividend
- Cash Dividends
- Stock Splits
- Due Bills
- Bond Interest

Legend:
- Primary Process Group
- Intermediate Group
- Process Thread
- Process Thread - does not currently exist
- impacted by BSCHBroker solution
Resulting Solution
Fixed Income Trading Process Map

Client
- Logs in
- "Personalized Web Page"
- Submits Order
- Validate Order
  - Valid
    - Yes:
      - "Electronic pass through"
      - Record Order
      - Monitor Execution
  - No:
    - Manual Review Needed
- Sales Desk Contacts Client

Front/Back Office
- Validate Order
- Record Order
- Trigger FX
- FX Process
- "Electronic pass through"
- Monitor Execution

OTC Market
- "Real-time alert"
- Update customer account
- Confirm Execution (price Qty, etc.)
- E-mail Confirmation
- Electronic Execution?
  - Yes:
    - Monitor Execution
  - No:
    - Non Automated Execution
    - Electronic submission execution

Is it Domestic?
- Yes:
  - Electronic Trading Available
  - Manual Review Needed
- No:
  - Route to Trading Desk

Electronic Trading Available
- Yes:
  - "Electronic pass through"
  - Record Order
  - Monitor Execution
- No:
  - Route to Trading Desk

Manual Review Needed
- Yes
- Update customer account
- Confirm Execution (price Qty, etc.)
- E-mail Confirmation

E-mail Confirmation
- Yes
- Update customer account
- Confirm Execution (price Qty, etc.)
- E-mail Confirmation

Electronic Execution?
- Yes:
  - Monitor Execution
  - Electronic submission execution
- No:
  - Non Automated Execution
  - Electronic submission execution
# Typical Fixed Income Legacy Systems

<table>
<thead>
<tr>
<th>Order Process</th>
<th>System</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rossi (OPICS)</td>
<td>• Used for accounting purposes</td>
</tr>
<tr>
<td></td>
<td>S.A.M.</td>
<td>• Order routing system</td>
</tr>
<tr>
<td></td>
<td>SIOPEL</td>
<td>• System that shows the market</td>
</tr>
<tr>
<td></td>
<td>CRYL</td>
<td>• The central clearing system for Argentina fixed income products</td>
</tr>
<tr>
<td></td>
<td>INDEVAL</td>
<td>• A clearing vehicle for international trades</td>
</tr>
<tr>
<td></td>
<td>EUROCLEAR</td>
<td>• A clearing vehicle for international trades</td>
</tr>
<tr>
<td></td>
<td>CEDEL</td>
<td>• Performs Custody role for retail fixed income products</td>
</tr>
</tbody>
</table>

| Custody       | Rossi          | Performs Custody role for retail fixed income products |

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<th>System</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPICS</td>
<td>• Order routing system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clearing/Settlement</th>
<th>System</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INDEVAL</td>
<td>• The central clearing system for Mexican Securities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Custody</th>
<th>System</th>
<th>Functionality</th>
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<tr>
<td></td>
<td>OPICS</td>
<td>• Performs Custody role for retail fixed income products</td>
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</table>
Fixed Income Solution
Capabilities Matrix
## Preliminary Capabilities Matrix

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>Technical</th>
<th>Competitive</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customization / Personalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Relationship Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficient cross- and inter-enterprise communication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast, cost-efficient data links with partners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>True integration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuously available hardware platform (24 x 7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global portal (multi brand, multi channel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Localization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open, extensible, flexible architecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global eTrading business application support</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Best-of-breed global e-trading solution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Secure transactions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Collaboration (online chat)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Real-time quotes, financial news, research</td>
<td></td>
<td></td>
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<tr>
<td>• Online help and training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Alerts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Analytics (“what if” scenarios)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Online operation (order status, billing &amp; pricing,</td>
<td></td>
<td></td>
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<tr>
<td>accounting, portfolio management, etc.)</td>
<td></td>
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</table>
Deriving a Conceptual Technology Vision
Using an Architecture Framework

Application Suites

<table>
<thead>
<tr>
<th>Business Processes</th>
<th>Security</th>
<th>Personalization</th>
<th>Community</th>
<th>Content Management</th>
<th>Catalogs</th>
<th>Commerce</th>
<th>Information Access</th>
</tr>
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<tbody>
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Enterprise Application Frameworks /Servers

Other Application Frameworks /Servers

Systems Management

Hardware/Operating Software

Hosting Services
Operations & Technology Support Vision

Technology support should support a vision that will guarantee a unique experience for e-Trading customers anywhere in the world.

Legend:

- **VPN**: Virtual Private Network
- **I/Fs**: Interfaces
- **ECNs**: Electronic Communication Networks

---

**Central Office**

- **Management**
  - CEO
  - Vision & Strategy
  - Legal
- **Trading**
  - Order Mgmt
- **Accounting**
  - Global Account Mgmt
- **Marketing/Sales**
  - Customer Support
  - Customer Profiling
  - Analytics
  - Administration
  - Development
  - Support
- **IT**
  - A/C Open
  - Kiosks
  - Customer Relationship Management
  - Campaigns
  - Technical Support
  - Customer & “Street-Side” operations & accounting
  - Country management
- **Call Center**
  - Customer Relationship Management
  - Country campaigns
- **Settlement, Operations & Accounting**
  - Online Trading
  - Research
  - Community/Chat
  - Education
  - Country management
  - Order Mgmt
  - Customer Support

**Country Offices**

- **Branch Support**
  - A/C Open
  - Kiosks
- **Marketing/Sales**
  - Customer Support
  - Customer Profiling
  - Analytics
  - Administration
  - Development
  - Support
- **IT**
  - Technical Support
  - Customer & “Street-Side” operations & accounting
  - Country management
- **Settlement, Operations & Accounting**
  - Online Trading
  - Research
  - Community/Chat
  - Education
  - Order Mgmt
  - Customer Support

**FI E-Trading Customers**

- **CEO**
- **Retail Clients / Advisors**

---

**Global Front-End System**

- **Connectivity**
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / IVR / Fax back

**Front Office I/Fs**

- **Connectivity**
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / Email / Chat / Phone / PDAs / VPN

**Enterprise Services**

- **Connectivity**
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / VPN / Phone
  - Web / Email / Chat / Phone / PDAs / VPN

**3rd Party System I/Fs**

- 3rd Party Broker Systems
- Remote E-Brokers

---

**Data Repositories**

- **Data Warehouse**
- **Local Databases**
- **3rd Party Systems**
- **Exchanges**
- **ECNs**
- **Data Providers, etc.**
Sample Trading Process

Legend:
- Global Front End System
- Integrated Value Chain Support Systems
- Local Back-Office System
- Third Party Services

Order gets routed locally

Local Office Staff

Main Office Staff

Order Routing

Order Confirmation

Order Placement

Retail Client

Internet

Technology
Architecture Enabled Capabilities

Web & Enterprise Integration Portal

Front Office Interfaces

PBX-Based Service
Call Forwarding, Teleconferencing, etc.

Remote Access

Front Office Apps
Financial Applications

Maintenance Apps
Web/Intranet Office only

Web-Enabled Applications

Content Mgmt

Lights Out Svs
Email, FTP, XML, Fax

4: Trading Customer Interfaces

Telephony-Based Services

Customer Care Handling

Customer Care Mgmt.

Remote Access Services

Voice/Data Integration

24x7 Services

Business Applications Support

Localization and Customization

Content Mgmt

News & Information, Research, PDF-formatted reports and statements

Customer Relationship Mgmt

Global eTrading, Account Mgmt, Order Mgmt, Financial Planning, Financial Statements

Help, Tutorials, etc.

Education, Games

Community

Enterprise Services & Back Office Applications

Integrated Value Chain Support System

Web Server Subnet

Search Engine

Research, News & Information

Secure Online Transactions

Enterprise Application Integration (EAI) Server

Message Service

Integrated Trading Data Warehouse Server

Metadata Repository

Global eTrading

Relationship Commerce Application Server (distributed n-tier architecture)

Personalization Server

Process Automation & Dynamic Content Mgmt.

Session/State Mgmt.

System and Application Maintenance & Support

Content Management System

Document Mgmt.

Image/Graphics Mgmt.

Video Server

News & Information Archives

DataWarehouse-Driven Decision Processing Application Package

DataWarehouse Information Template

DataWarehouse Interface

Trading & Back Office Support Systems

Legacy Operational Systems

Regulatory Management

Order Management & Accounting

Clearing / Settlement

Customer Care Services

Order Processing

Legacy Integration Middleware

Trading & 3rd Party Interfaces

Trading & 3rd Party Interface

Security

Firewall / Proxy Server

Internet Services
web, ftp, email & news servers

Voice/Data Integration

Teleweb / Web Integration Services
Consolidated Messaging, Telephone-Based Web Services, Video Conf., etc.

Search Engine

Transaction Service

Messaging Service

Analytical Applications
Performance Reports, Performance Measurement Analysis, Trend Analysis and Forecasts, etc.

DataWarehouse Information Template

XML Parsing & Translation

Custody Management

Corporate Action Management

Corporate Mail, etc.

Research Management

Order Fulfillment

(FI, Equity, Funds, Others)

Order Management & Accounting

Self Care Services

Customer Service, Help Desk, Sales Automation, QA

Financial Apps Logic

(e.g., order book management)

Site Development Svc.

Updates Staging Server

Legacy Integration Middleware

straight through processing support software

Trading & 3rd Party Interfaces

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(e.g., order book management)

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Legacy Integration Middleware

straight through processing support software

Trading & 3rd Party Interfaces

Trading & 3rd Party Interface

Custody Management

Corporate Action Management

Corporate Mail, etc.
Architecture Scalability Features

• “Statelessness”
• Subject-based distributed queues (EAI)
• Load distribution
• Fault-tolerance
  – Notification: Primary/Secondary failover
  – Recovery
  – Verification against state signature
  – True Hot Standby
Architecture Support for Fixed Income Market Inventory

• Role-based market views
• Pre and post-trade workflow supported
• All Fixed Income instruments supported
Architecture Support for Client Access

- Local, specialized user interfaces
- API’s
- Internet access
- Legacy order streams
Architecture Security Features

- Encryption standards: 128 bit RSA: RVDS
- X.509 compliant certificates: TIBCA
- Level 5 firewall architecture
Architecture Support for Legacy Order Stream

• Legacy messaging interfaces seen as a user of the system
• Interoperates with existing users
• Can act as a bridge between deployed hubs
From a Logical Infrastructure to a Physical Solution
## Considering Mainstream Tools

### Custom Integration and/or Integrated Applications (SAP, Baan, Lotus Notes, PeopleSoft)

<table>
<thead>
<tr>
<th>Components</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security:</strong></td>
<td>Firewalls—Axent, Cybercop, Firewall-1, Security Dynamics/RSA, Verisign Certificate—Entrust, GTE/Cybertrust, Thawte Verisign LDAP—Microsoft, Netscape Other—Netegrity/SiteMinder, Platinum/Security</td>
</tr>
<tr>
<td><strong>Personalization:</strong></td>
<td>Accelry, Andromedia, Aptex, ATG, BroadVision, DoubleClick, Engage, NetGravity, Net Perceptions, Vignette/StoryServer</td>
</tr>
<tr>
<td><strong>Community:</strong></td>
<td>Acuity/iChat, AT&amp;T, Brightware, eshare, General Interactive, Lexis-Nexis, Lotus/Domino, Microsoft/NetMeeting, Netscape/Collabra, Podium, Revnet/UnityMail, Siebel, Vantive</td>
</tr>
<tr>
<td><strong>Content Management:</strong></td>
<td>ATG, BroadVision, Documentum, FactPoint, FutureTense, HP/OpenPix, Inso/Dynabase, Interwoven, Lotus Notes, Open Text, RealNetworks/Real Audio-Video, Vignette</td>
</tr>
<tr>
<td><strong>Catalog:</strong></td>
<td>Aspect, ATG, BroadVision, iCat, OpenMarket/LiveCommerce, Saquar</td>
</tr>
<tr>
<td><strong>Commerce:</strong></td>
<td>ATG, Atlantic Transaction Services, Ariba, BroadVision, CommerceOne, ConnectIInc, CyberCash, ECCubed, H-P/VeriFone, IBM/net.commerce, InterWorld, Microsoft/SiteServer Commerce Edition, MOAI, Netscape/Xperts, Open Market/Transact, OpenSite, Sterling, TradeX, Tradian, Tradium, TradingDynamics, Transport</td>
</tr>
<tr>
<td><strong>Information Access:</strong></td>
<td>ATG, BroadVision, CrossWorlds, Fulcrum, H-P/ChangeEngine, Inktomi, Microsoft/SearchServer, Objectspace, Verity</td>
</tr>
<tr>
<td><strong>Inter-Enterprise:</strong></td>
<td>data exchange (XML/EDI): CardoNet, EpiCenter, Extricity, MBA, OnDisplay, Sterling, WebMethods</td>
</tr>
</tbody>
</table>

### Web Application Frameworks

- Allaire/ColdFusion, Apple/WebObjects, ATG/Dynasty, Bluestone/Sapphire Web, BroadVision, HAHT/HAHTSite, IBM/WebSphere, Microsoft/WM Server (Enterprise Edition), NetObjects/Fusion, Pramati Technologies/Proton, SilverStream, Vignette

### Business Application Frameworks

- BEA WebLogic, Inprise, IONA/Orbis, Microsoft/MTS, Netscape Application Server, Oracle Application Server, Pervasive Software/Tango Enterprise, Sun/NetDynamics

### Database

- Informix, MS-SQL, Oracle, Sybase

### Systems Management

- BMC/Logical, HeadsUp, Hewlett-Packard/HPOpenView, Manage.com, Sun, SystemHealth

### Testing

- RadView/WebLoad, RSW/e-test, LoadRunner, SystemHealth

### Hardware/Software

- NT/Intel - Compaq, Data General, Dell, Gateway, H-P

### Network

- ArrowPoint, 3Com, Cisco

### Hosting

- Digex, EMC, Exodus, GlobalCenter.com, GTE Internetworking, HostPro, MCI, Navisite, PSInet, UUnet

Typically read as Vendor/Product Name
# Evaluating Alternatives

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>(1) Web Enabled Legacy</th>
<th>(2) Combined Vendor Packages</th>
<th>(3) Component Web</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed to Business</td>
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<td>Long-Term Viability</td>
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<td>Cost of Ownership</td>
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<td>Alignment with Vision</td>
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<td>Business Risk</td>
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<tr>
<td>Simplicity/Ease of Use</td>
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<tr>
<td>Overall Rating</td>
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</tbody>
</table>

- **Worst**
- **Good**
- **Best**
Physical Architecture (Example 1)
Technology Infrastructure
Physical Solution
Implementation Steps
## Development Methodology

<table>
<thead>
<tr>
<th>Practice Areas</th>
<th>Stages</th>
<th>Blocks</th>
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<tbody>
<tr>
<td>Business System Development</td>
<td><strong>Discover</strong></td>
<td>Business Modeling</td>
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<td>User Experience</td>
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<td>Content Development</td>
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<td>Application Architecture and Development</td>
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<td>Technical Architecture and Development</td>
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<tr>
<td>Management and Quality</td>
<td><strong>Design</strong></td>
<td>Testing</td>
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<td>Performance Engineering</td>
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<td></td>
<td><strong>Develop</strong></td>
<td>Program/Project Management</td>
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<td>Configuration Management</td>
</tr>
</tbody>
</table>
Identifying Domains of Change

- Implementation team
- Training team
- Data conversion
- Supplied volume data
- Hardware
- Standard system software
- Reporting software
- Ad-hoc spreadsheet functions
- Security and performance
- Projects creation and update
- Projects approval
- KPI creation
- Project information retrieval
- System administration
- Site navigation design
- Site content design
- Reusable components
- Security workflow
- Help
- Office hosting development
Adding Iterations

Development is an iterative process, where for each subset of requirements, components must be analyzed, designed, developed and deployed.
Conclusion
Feature Summary

- Ubiquitous Client Access
- Pushes Status in Real-time
- Framework Inter-operates with Legacy
- Support for Current and Emerging Standards
- Scales in Capacity and Function
- Optimization of Integrated Services
- Secure, Mission-Critical Infrastructure
Addressing the Challenges

- Existing legacy systems and newer ATS’s will still need to handle anticipated increases in trade volume implied by the development of STP.
- Fixed Income securities can have complex structures. Trading systems can plug and play analytics to calculate various essential data.
- There are many types of Fixed Income securities which trade in different ways. Standardized trading methodologies will need to be applied.
- Security information repositories will need to be large enough to hold data on millions of securities.
- Present front-end interfaces are no more than client/server versions of legacy systems.
- Back-office systems are antiquated. It may not be feasible to integrate them if they cannot support the new economy business.
- The new Fixed Income market of tomorrow may require an Application Program Interface (API) to a single Fixed Income exchange.
- T+1 must be incorporated into new technology.