

13 Exchange Technology

Agenda



- Functions of Exchange System
- System Architecture
- Order Entry Gateway
- Order Matching
- Market Data Distribution
- Post-trade Processing
- Market Surveillance
- Clearinghouse Interface

Essential Functions

Key Functions of Exchange Systems



- Order entry – capture orders from clients easiest possible
- Order Management – manage client orders and push all valid orders for execution
- Order matching – Run matching algorithms to match buy and sell orders
- Market Data Distribution – distribute market data elements as orders flow through the system
- Interface to Clearinghouse (real-time) – send matched orders and other required information to clearinghouse

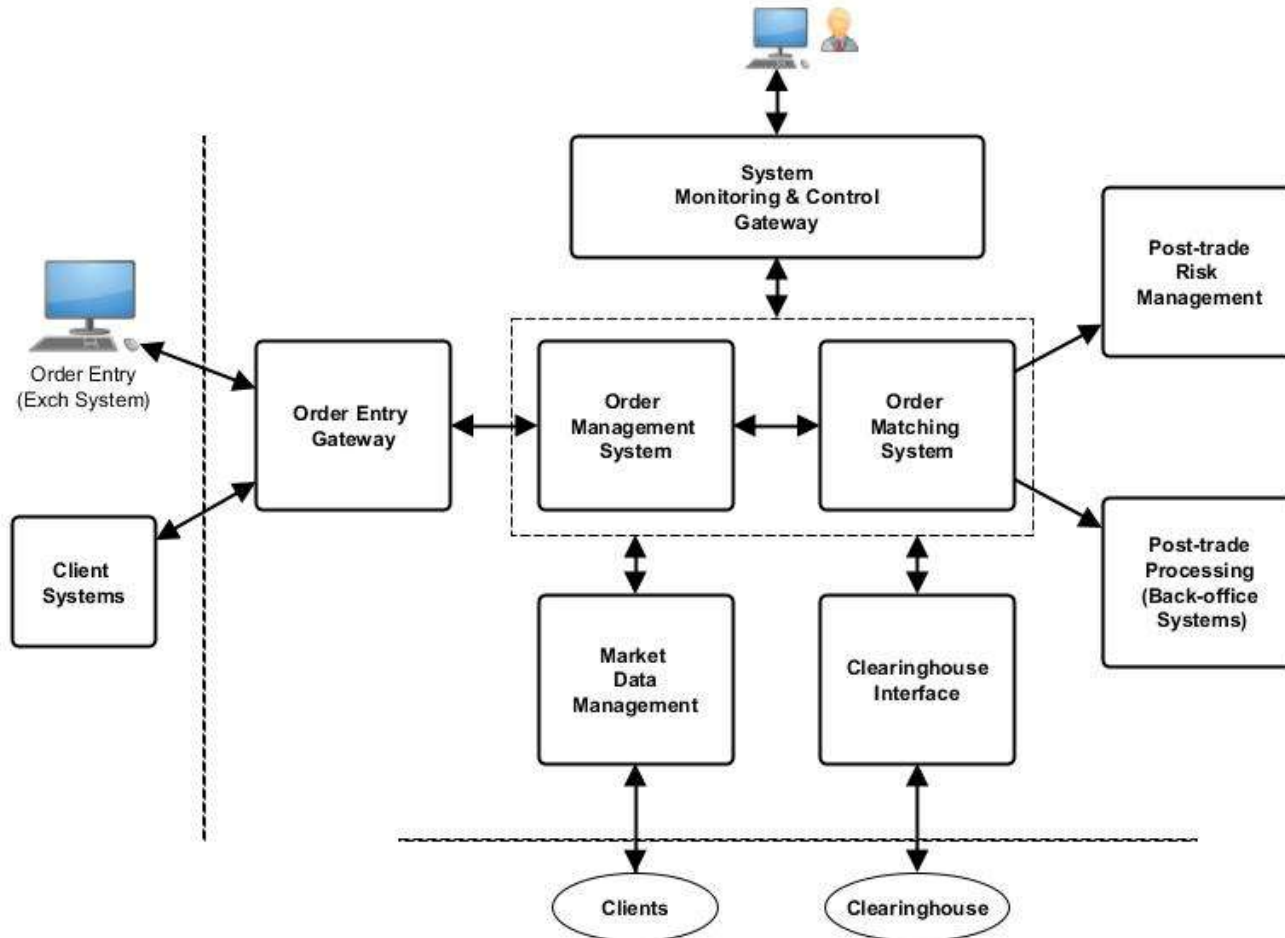
Key Functions of Exchange Systems ..cont



- Real-time and Post-trade Surveillance – apply surveillance rules during order matching as well as after-execution and produce alerts
- Monitoring Modules – provide monitoring and control of all system activities
- Reporting Modules – produce reports as scheduled and on-demand
- Audit Capabilities – ability to audit order activities

System Architecture

Architecture



Key Components



- Order Entry Gateway
- Order Entry System for clients (Direct and API)
- Order Management System
- Order matching engine
- Market Data Mgmt. & Distribution
- Clearinghouse Interface
- Platform Monitoring & Control
- Post-trade Risk Mgmt.
- Post-trade Processing

Order Entry Gateway



- Open Interface – support for standard protocols like FIX
- Support native clients - Direct web based client interface (to support small and mid-size client access) or similar
- low-latency, high throughput capabilities
- Provide secured access – must be protected
- Provide order validation, limit checks other integrity and risk management controls

Order Management System



- Manage orders (order book, executions etc.)
- Apply pre-trade validations
- Route orders as matching engine
- Process client queries on order status etc.
- Manage reference data (contract definitions etc)
- Manage corporate actions etc.

Matching Engine



- Continuous or event driven order matching (execution matching algorithms)
- Support for required order types
- Real-time price and execution information dissemination (market data)
- Provide access to order-book in real-time
- Support Circuit breakers other risk management controls
- Support real-time surveillance as needed
- Distribute matched orders to clearinghouse, post-trade processing and risk mgmt. and others
- low latency, high throughput capabilities
- Must be scalable (hundreds to thousands)

Market Data Distribution



- Distribute order book – best bids, asks etc.
- Distribute execution information as orders are matched
- Distribute reference data (security info etc)
- Respond customer queries etc.

Surveillance and Compliance (Post-trade)



- Real-time - proactively detect potential abusive trader behavior patterns and take remedial action
 - Rules/patterns are built based on products, markets and other conditions
 - Eg – price movements, volumes, volatility
- Post-trade analysis
 - Perform planned/programmed analysis on executions
- Generate alerts as required
- Take actions if needed, such as enabling circuit breakers

Clearinghouse Interface



- Supply real-time execution data
- Supply Settlement prices as scheduled
- Serve queries
- Supply static data
- Sync client account information

Monitoring & Control



- Monitor various flows
- Monitor state of various components
- Monitor real-time surveillance alerts
- Perform any required system operations

Integrity and Risk Management Interface



- Risk management Interface – allows to manage all parameters required for integrity controls and risk management tools
- Allow user to manage parameters -
 - Integrity controls
 - Trading Limit controls
 - Clearing Limit controls
 - Risk management control parameter

Post-trade processing



- Perform required activities on executions
- Client Account maintenance
- Fee calculations etc.
- Book keeping
- Financials etc.

Communication Protocols



- FIX protocol is popular communication protocol
 - Between clients and Exchange - Order entry, executions, status reports etc.
 - To clearinghouse - Execution information and other information
- Robust communication platforms are used
 - Secured networks
 - Message Queues (MQ) based message flows
- On-demand services interface – to server queries and various reports
 - Web-based applications etc.
- FAST (FIX Adapted for Streaming) is becoming popular for market data distribution
- More info
 - <https://www.fixtrading.org/what-is-fix/>
 - <https://www.fixtrading.org/standards/fast/>

Common Market Manipulation Practices



- **Quote Stuffing**
 - Trade quickly entering and withdrawing a large number of orders in an attempt to flood the order book
 - As order book published live, it creates image in market that there is large activity, in fact, it is not (trader withdrawing)
- **Layering/Spoofing**
 - Trader places orders at different bid/asks and cancels before execution
 - Creates false demand and supply.

Common Market Manipulation Practices ..cont



- **Momentum Ignition**
 - Quickly placing orders that get executed, driving the price in required direction
 - Creates image of market movements, which is not of real demand supply
 - Typically done through programs (algorithmic trading)
- **Front Trading**
 - Broker stepping in front of on large his own client orders to gain economic advantage.
 - Large orders impact the price, so this knowledge may benefit trader economically.
 - Many market regulations provide rules/guidelines
- **Wash trading**
 - Trader buys and sells the same instrument for the same account
 - Used to benefit from such as tax deductions (book losses)

Common Market Manipulation Practices ..cont



- **Painting the tape**
 - (group of) traders buying and selling same instrument among themselves to drive the prices and/or show the trading volumes
 - This false market image may attract other investors enter market and driving prices higher
 - Original trade would then dump their positions
- **Marking the close**
 - Just before market close, traders execute orders in an attempt to influence the closing price of an instrument
- **Insider trading**
 - Trades placed by parties who have insider information such mergers, acquisitions, financial reports, deals etc.
- **Ping Order**
 - Orders used to seek hidden quantities resting on a dark book

Common Erroneous Trading



- Fat finger orders
 - Orders entered by mistake
 - Unusually large volumes
 - Unusual prices (eg: much below asking prices)
- Orders resulting from flaws in program trading (algorithms)

Matching Engine Vendors



Commercial Products

- NASDAQ Business Solutions - <https://business.nasdaq.com/market-tech/marketplaces/trading> (Also refer to regional divisions)
- PATSYSTEMS – <http://www.patsystems.com/exchangeSolutions/Overview.aspx>
- MarketGrid - <http://marketgridsystems.com/technology/key-features/>
- Connamara - <https://www.connamara.com/reg-exchanges/>

Some Open Source Implementations

(For the reference only)

- Liquibook - <https://github.com/objectcomputing/liquibook>
- ParityTrading - <http://paritytrading.com/> - <https://github.com/paritytrading/parity>

Market Surveillance Products



- NASDAQ SMARTS - <https://business.nasdaq.com/market-tech/marketplaces/market-surveillance>
- AQUIS - <http://www.aquis.technology/aquis-market-surveillance/>
- Other

Other Software Resources



Protocols

- QuickFIX – FIX Engine – large number of installations in financial industry - FREE
- QuickFAST – FAST implementation – becoming popular
- Market Data Distribution Protocols

Questions

