BC3402
Financial Service Processes and Analytics

Financial Network (II):
Electronic Trading Networks

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Outline

- Financial Trading Networks
  - ECN
  - Crossing Networks
  - Networks generated data
- Technology supporting trading networks
  - DMA tools
  - FIX

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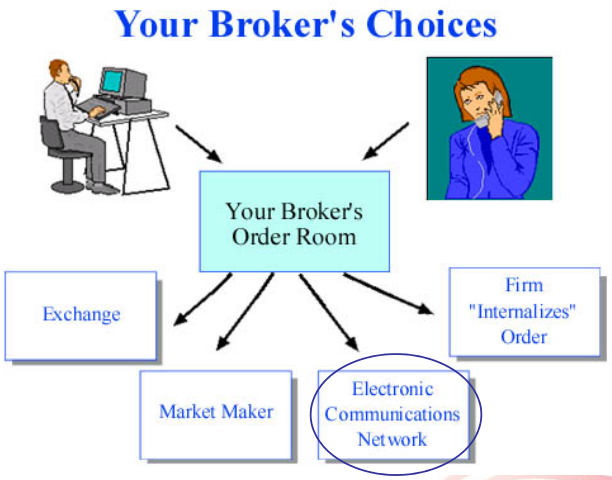
Execution of a Trade



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Electronic Communication Networks (ECNs)

- The are alternative trading systems (ATS) that is registered and regulated by SEC
- ATS: Non-exchange electronic trading systems that automatically match and sell orders at specific prices
  - Trading without the need of regular exchanges
  - Permits matching of bid and ask quotes
- May potentially eliminate involvement of trader (sell-side)

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Electronic Communications Network (ECNs) (cont'd)

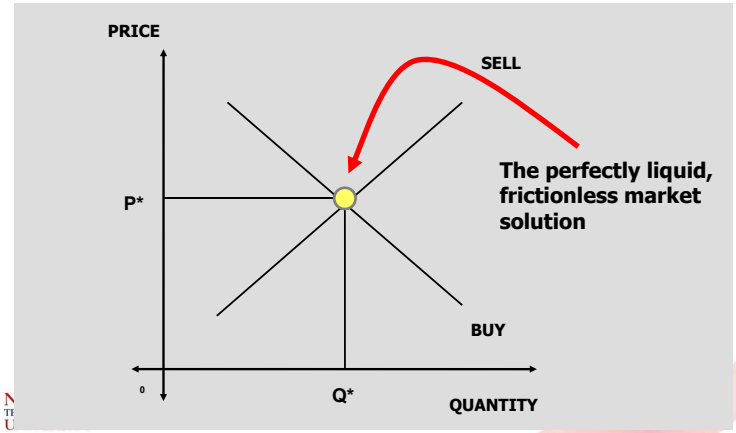
- Each ECN has its own liquidity pool
  - Formed by technological firms, so how do they attract liquidity?
  - $0.005
- Orders come in to the ECN and are immediately matched against the trader's initial parameters within the ECN
- How do ECNs match the trades?

Types of ECN: Market Structure

- Continuous Limit Order Book
  - Order book displays orders and rank them by price and then by time
- Single Price Auction
  - Participants submit bids and offers over a period of time
  - System execute all trades at the same time with a same price to maximize trading volume
- Passive Pricing
  - Refer to other systems/ exchanges for trading prices, no price discovery

ECONOMICS 101

The closest thing to it is a Call Auction



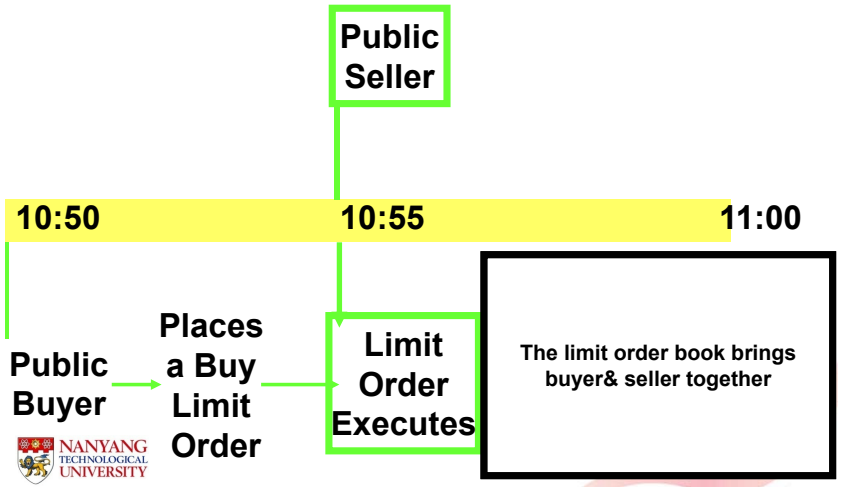
The Big Problem

Enabling Buyers and Sellers, Large and Small, to Find Each Other

Two Dimensions

- Place
- Time

Order Driven Market



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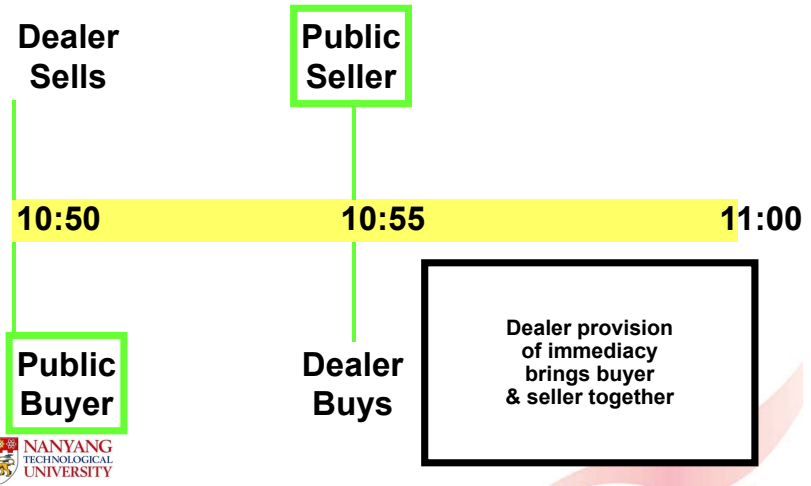
Dealer Intermediation



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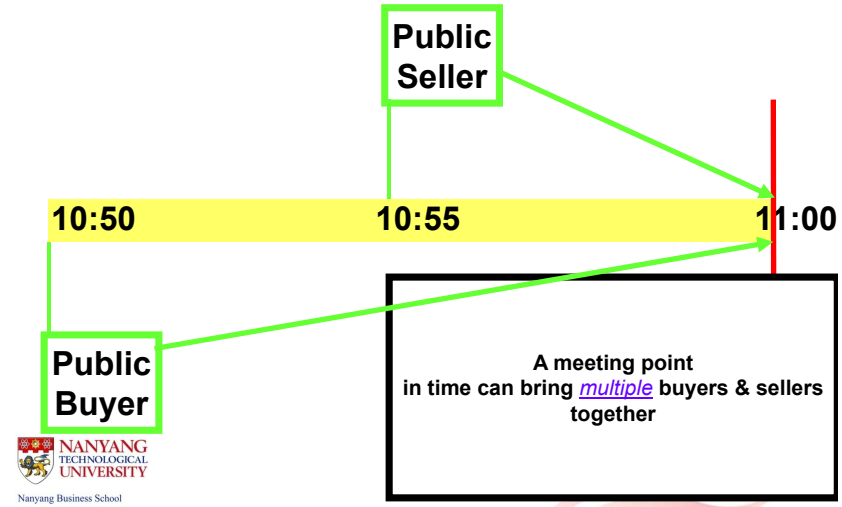
A Call Auction



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The Electronic Call Auction

- Orders that could otherwise be matched and executed are held for a big, multilateral clearing
- Clearings are held at pre-determined points in time (i.e., once an hour)
- All crossing orders are executed at a single price
  - Buy orders at that price and higher execute
  - Sell orders at that price and lower execute

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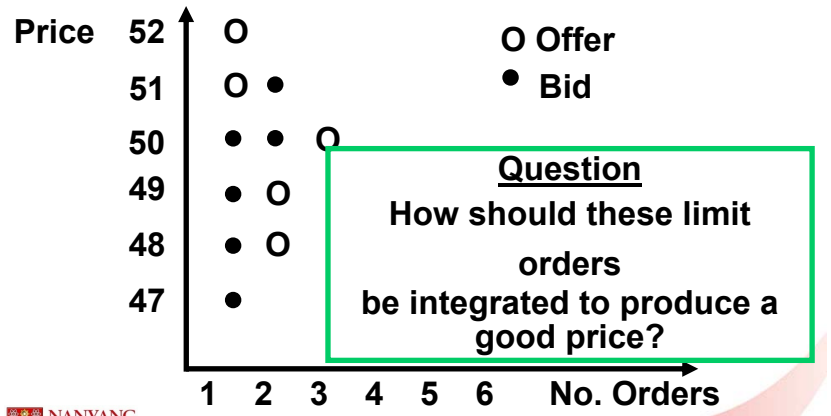
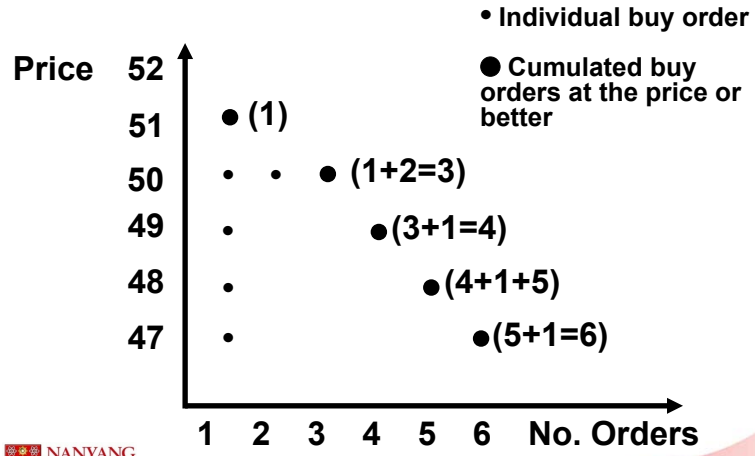
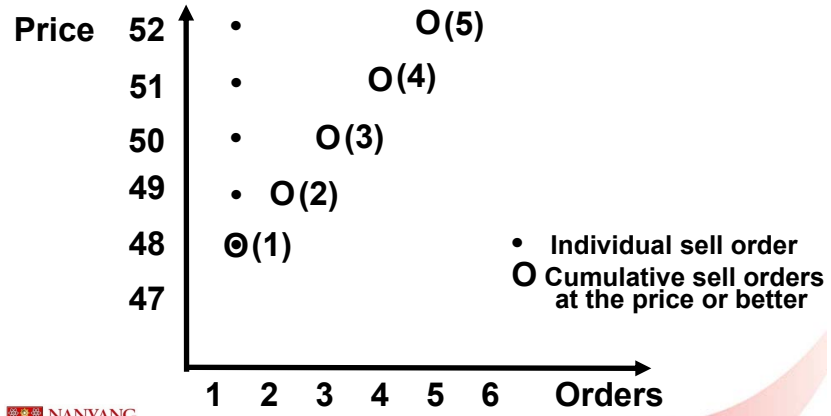
The Batching of Customer Orders



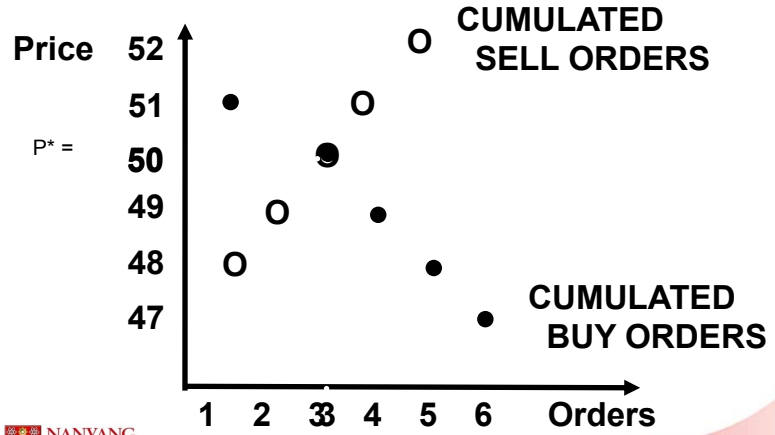
Cumulate The Buy Orders



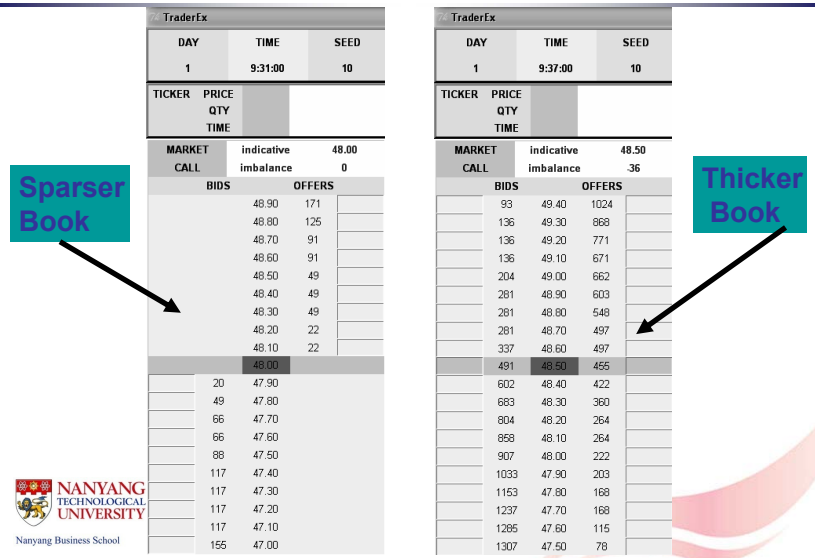
Cumulate The Sell Orders



Match Cumulated Buy & Sell Orders



Call Auction Limit Order Books



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When Calls Are Used

- Market Openings
- Market Closings (MOC & LOC orders)
- Nasdaq's Crosses (open and close)
- Intra-day
  - ✓ At a predetermined time
  - ✓ To reopen the market after a trading halt

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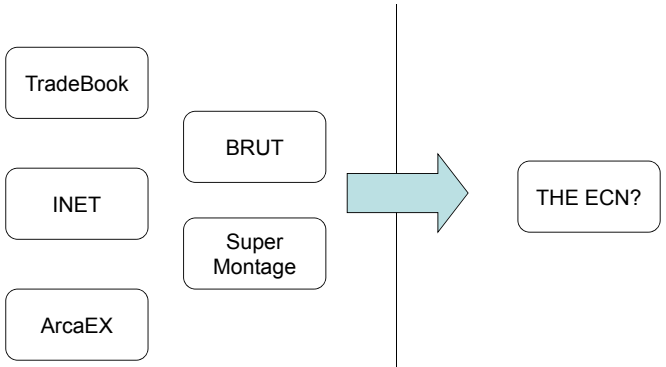
List of Largest ECNs in mid 2000s



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ECN trading

- In general, ECNs have lower liquidity than major exchanges like NYSE or NASDAQ, so what happens when an order is send to an ECN and is not fulfilled?
- If order is not executed, it may be routed to a competing ECN
- Permits direct connection to trading venues and utilized smart-routing concepts (to different venues) to fulfill order specifications with aid of Direct Market Access (DMA) tools

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Information Transferred on ECN

- Security identification (ticker e.g. JPM, WFC)
- Buy or sell order
- Trade price
- Trade date
- Order instruction (e.g. market, limit, fill or kill)
- Broker identification
- Details of buyers/ sellers are hidden

ECN Order Types

- Committed order flow: orders that are submitted into the ATS and are available for immediate execution.
- Uncommitted order flow: orders that are available for execution, but require confirmation before execution.
- Pass-through order flow: orders on their way to another execution venue, such as an exchange or ECN, may pass through an ATS first to attempt a cross, or IOC (immediate or cancel) to “ping” for liquidity, without leaving the order in the system for any length of time.
- Negotiated order flow: requires more human interaction, and indications provide information that a counterparty is available in the ATS.

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Advantages of ECNs

- Match buyers and sellers directly: bypass human intermediaries -> lower transaction costs
- Allows buy-side traders to access multiple execution venues and liquidity pools without broker’s trading desk -> increase efficiency of the market (reduces information asymmetry)
- Facilitate hedge funds – the most aggressive users of ECN
- At times: anonymity in trading
- 2004 – 34% of buy-side trades are through ECN related systems

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Reasons for Choosing ECN

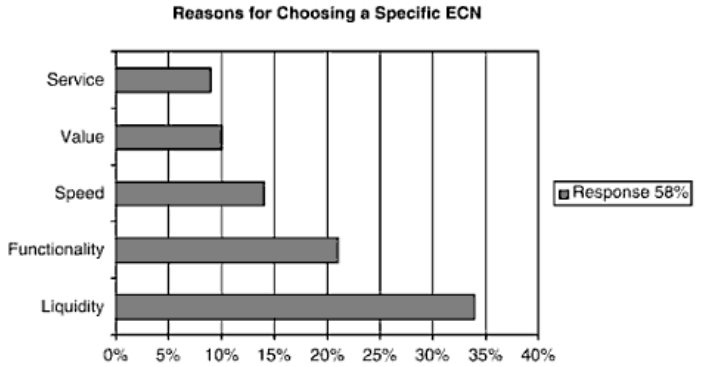

Exhibit 7.5 *Source: LLC Institutional Equity Trading in America*, TABB Group, April 2004.

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ECN Revenue Model

- Commission: very low ($0.005 per share) sometimes "free"
- Other Fees
  - Use of DMA software
  - Inactivity fee/ Minimum trading volume
  - Interest spreads
- Use by:
  - Day traders (high volume trades)
  - Technical traders
  - Scalpers (low slippage required)

Implications of ECN

- Algorithm Trading (in subsequent lectures) and FIX protocol
- What is the role of the broker now?
  - Need to differentiate their services: not mere trading
- ECN are known to cause liquidity fragmentation in equities.
- Consolidation of ECNs
  - NYSE and NASDAQ purchases
  - NYSE Arca – former known as ArcaEx is originally created by archipelago
  - INET – bought over by NASDAQ from Instinet
  - BRUT – Sungard (sold to NASDAQ)
  - SuperMontage – Nasdaq properiety ECN
- Costly for brokerages to provide technology to support ECN – ranging from $15 to $50 million (TABB Group)

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Questions

- Imagine you are an institutional trader and intend to execute a block trade (i.e. a large trade of a single security). Would you list your entire order directly on an ECN? If not, how will you execute it?
- What kind of ECN market structure do you think works best for you (CLOB, Single Price auction, passive)?

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Crossing Networks

- Another form of ATS
  - Network system that matches block (large) trades anonymously.
  - Limited or no trade information is provided
  - Party A wishes to sell 100,000 shares of XYZ, at $10.50 (or higher). Puts the order into a crossing network and waits.
  - Party B comes along (without knowledge of any display quotes), places buy order of 100,000 XYZ at $11.00 (or lower).
  - System will match and determine the transacted price based on a variety of parameters. No negotiation.
  - Prevents information leakage
  - Dark pools?

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Examples of Crossing Networks

- Credit Suisse (Crossfinder)
- Instinet (Instinet Crossing)
- Investment Technology Group (POSIT)
- LiquidNet (Liquidnet)
- NYFIX Millennium (Millennium ATS)
- NYFIX Transaction Services (NYFIX Natural)
- Pipeline Trading Systems (Pipeline)
- UBS (UBS Pin)

Crossfinder

- The system crosses orders on a continuous basis at prices at or better than the NBBO (National Best Bid/Offer).
- Approximately 122 million shares per day.
- Institutional, retail and liquidity partners
- Types of orders: Market and limit orders eligible for execution at or within the NBBO
- Time of crossing: Continuous crossing during market hours
- Fee structure: Rates are negotiated on individual basis.

POSIT

- Match equity orders with complete confidentiality, access to diverse liquidity pools, zero market impact, and the cost savings of midpoint pricing.
- Currently 700+ clients participate, comprised primarily of institutions, broker-dealers and hedge funds All US equities are eligible to cross in POSIT
- POSIT MatchTM has 13 cross times a day: 9:45 am, 10:00 am, 10:15 am, 10:30 am, 11:00 am, 11:30 am, 12:00 pm, 12:30 pm, 1:00 pm, 2:00 pm, 3:00 pm, 3:30 pm; after hours at 4:45 pm. POSIT NowSM offers continuous, anonymous crossing throughout the trading day.
- Commission on a per share basis

Participants of Crossing Networks

- Some crossing networks do not allow sell-side broker-dealers to join (E.g. NYFIX Natural, Liquidnet). Why?

Potential Problems

- Strong claims and potential misrepresentation by providers
  - Pipeline Trading scandal 2011: false claims of confidentiality. Owners of pipeline owned trading company that provides the orders
  - Barclays dark pool scandal 2014/5: HFT vs non-HFT. Claims that it is HFT free, but alleged to have invited HFTs.
- Main value proposition is secrecy: So who and how to monitor?

Changes in Order Flow Patterns

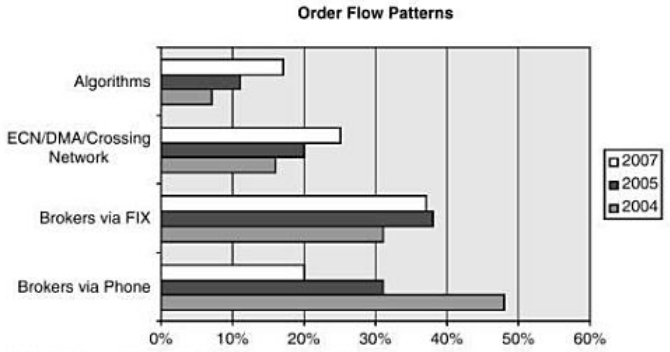

Exhibit 7.6 *Source:* TABB Group, June 2005.

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Ownership of Content in Networks

- Who owns the market data?
  - Quotes, last done prices etc.
  - Historically (late 1800s) – those who produces it owns it i.e. exchanges.
  - 1975, SEC
    - promote public assess to market information, "requested" national exchanges to "eliminate rules that restricted assess"
    - "reasonable fees" is acceptable
  - How about Singapore? STI index figures?

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Source of Revenue for Exchanges

Exchange	Market Data Revenue (US$ millions)	Trading Volume (US$ trillions)	Market Capitalization (US$ trillions)	Market data revenue per trading volume
NYSE	$172	$10	$11	17.73
NASDAQ	$147	$7	$3	20.70
Tokyo	$60	$2	$3	50.00
London	$180	$4	$3	50.00
Euronext	$109	$2	$2	57.37
Deutsche Bourse	$146	$1	$1	112.31

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Technology Supporting Trading Networks

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Direct Market Access (DMA) Tools

- Technology used when we wish to by-pass the sell-side and trade directly at ECNs.
- A different face of Order Management System (OMS)
- Integral part of trading technology that facilitate the proliferation of ECNs
  - Aggregation technologies
  - Help route the orders to multiple trading venues (ECNs)
  - Useful in fragmented markets
  - Analyzes order, polls market, locate most efficient venue
  - Low cost to use these technologies

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Advantages of DMA tools

- Often facilitate STP, DMA tools can be made to integrate with other clearing or settlement systems.
- Order is captured in the beginning and the data for downstream post-trade activities, potentially reduce errors
- Faster trade execution (operationally)
- Tools enable buy-side to by pass sell-side therefore
  - Reduce transaction costs
  - Increase control
- May improve liquidity with the use of crossing networks or accessing to different liquidity pools (ECNs)

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Financial Information eXchange (FIX) Protocol

- The **Financial Information eXchange (FIX) Protocol** is a messaging standard developed specifically for the real-time electronic exchange of securities transactions. FIX is a public-domain specification owned and maintained by FIX Protocol, Ltd.
- The “TCP/IP” for financial trading networks
- ECN will not be possible without FIX
- First developed by Salomon Brothers in 1992 to facilitate trading between Fidelity Investments
- List of users of FIX http://www.fixprotocol.org/adopters/

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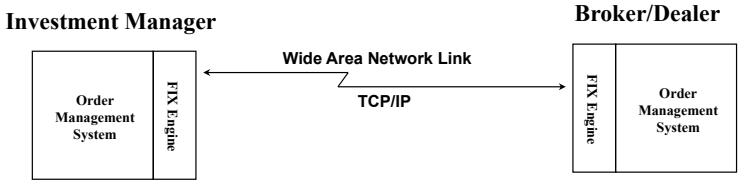
FIX Connectivity



FIX Message Structure

Message Header	**Identifies message type, message length, sender/destination ,sequence number, sending time, etc**
Message Body	**Contains specific session and application message content**
Message Trailer	**Contains optional digital signature and the required checksum value**

FIX Fields

<TAG>=<VALUE><DELIMITER>

Composed of four parts
------ <TAG>
------ "="
------<VALUE>
------<DELIMITER>
non-printing ASCII character (control character)

Example:
"8=FIX.4.2^"

FIX Single Order Example

8=FIX.4.1^9=0235^35=D^34=10^43=N^49=VENDOR^50=CUSTOMER^
56=BROKER^52=19980930-09:25:58^1=XQCCFUND^11=10^21=1^
55=EK^48=277461109^22=1^54=1^38=10000^40=2^44=76.750000^59
=0^10=165

Header

8=FIX.4.1	Begin String
9=235	Body Length
35=D	MsgType
34=10	MsgSeqNum
43=N	PossDupFlag
49=VENDOR	SenderCompID
115=CUSTOMER	OnBehalfOfCompID
56=BROKER	TargetCompID
52=19980930-09:25:58	Sending Time

Body

1=XQCCFUND	Account (optional)
11=12345	ClOrdID
21=1	HandInst
55=EK	Symbol
48=277461109	SecurityID (optional)
22=1	IDSource (optional)
54=1	Side
38=10000	OrderQty
40=2	OrdType
44=76.750000	Price (optional)
59=0	TimeInForce (optional)

Trailer

10=165	Checksum

FIX Messages

- Groups of Fields strung together to describe a business action

ADMIN/SESSION	APPLICATION
Logon	Advertisement
Heartbeat	Indication of Interest
Test Request	News Email
Resend Request	New Order, Executions
Reject	Order Cancel/Replace
Sequence Reset	Order Status
Logout	List Messages

FIX & security

- Public vs. Private Network
- Public internet
  - PGP/DES/MD5, since 1995
    - Encrypt core content within each FIX message
    - Send over network but in an unreadable format
    - Translate back to readable format on receipt
  - SSL Reference Implementation, since 2000
    - Create a secure tunnel that ensures all traffic inside the tunnel is private
    - Use this tunnel for all FIX traffic
    - Sender and receiver see in readable format but traffic cannot be seen by third parties
    - TLS is next generation of SSL and State of the Art

FIX & security

- Private networks
  - The network is secure
  - Most common approach
  - Normal on hub and spoke networks
    - Eg SWIFTNet, RITD, Bloomberg
  - And on VPN
    - Eg TNS, Radianz
- Combination
  - Use encryption over a connection to a private network

FIX & security

- FIX does not mandate security, BUT it can be used securely
- There are a number of approaches
- Generally any weaknesses are around poor implementation not the core technology
  - DES key may be a weakness but takes so long to crack that information is of little value