Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
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Market Manipulation Using Messaging Services:
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Addendum:
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Financial Messaging Systems
&
Market Manipulation

CyberSoc - Newcastle

2024/10/16

Demo & Slides:

https://fix.cybersoc.org.uk

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Messaging Systems:

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What is a Messaging System:

- ► Helps People Communicate,
- ► Connects Traders to Exchanges and Market Makers,

Life Before Messaging Systems:

- ► Trading Networks were hierarchical in nature,
- ► Expensive and slow for individuals to place trades,
- ► Not very fair market conditions, priority given to those higher up the hierarchy,
- ► Orders normally placed by phone, fax, or even mail!

Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
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Market Manipulation Using Messaging Services:
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Addendum:
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Historic Trading Network Topology:

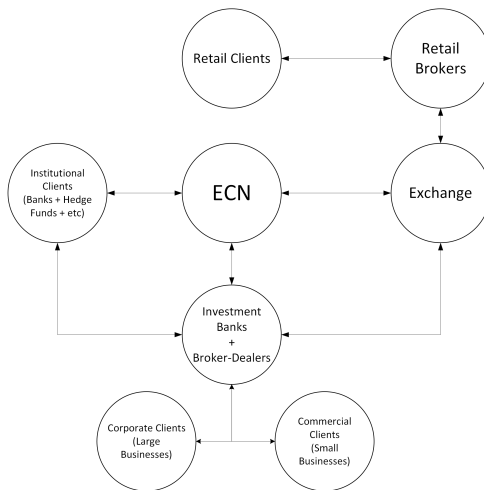Typical 20th Century Trading Network Hierarchy:

Exchange & Inter-dealer Brokers (Decentralised Exchange For FX),

- ▶ Broker-Dealers (Market Makers),
- ▶ Investment Banking,
    - ▶ Commercial Clients (Small Businesses)
    - ▶ Corporate Clients (Large Businesses)
    - ▶ Institutional Clients (Banks, Hedge Funds, Insurance, etc)
    - ▶ Private Banks (Wealth Management)
        - ▶ Retail Clients (Individuals / Day Traders)

The Rise of Electronic Trading and Rise of ECNs:

- ▶ Online Broker-Dealers provide direct access to exchanges!
  - ▶ To cope with the increased volume these Broker-Dealers often aggregate clients' orders and keep inventories of securities likely to transact in current market conditions.
- ▶ Exchanges + Inter-dealer Brokers slowly being replaced by Electronic Communication Networks (ECNs).
- ▶ These ECNs use complex matching engines to optimally match orders quickly!,
- ▶ ECNs provide a decentralised market topology,

Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
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Market Manipulation Using Messaging Services:
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Addendum:
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Contemporary Trading Network Topology:

Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
00000000

Market Manipulation Using Messaging Services:
000000

Addendum:
0000

Topic

Messaging Systems:

Messaging Protocol (FIX):

FIX Example:

Market Manipulation Using Messaging Services:

Addendum:

What is Financial Information Exchange:

- ▶ Financial Information Exchange or FIX is a protocol for transmitting orders, market data, news, mail + more!
- ▶ FIX is an Ascii encoded protocol,
- ▶ FIX is quite old now but still used by many institutions,
- ▶ Stores data in a keys and values - keys called tags,
- ▶ Each tag is delimited by a null '\0'
- ▶ Data is split into a header and a body,
- ▶ Data is processed by a **FIX Engine**
- ▶ Data is sent during a **FIX Session**, multiple messages can be exchanged in one session,

Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
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Market Manipulation Using Messaging Services:
000000

Addendum:
0000

User Authentication Methods For FIX:

- ▶ User authentication is important when communicating,
- ▶ There are many methods of user authentication available as FIX is very simple (in concept) and versatile,
    - ▶ FIX Session Level Authentication (Username + Password)
    - ▶ IP Whitelisting (Only allow connections from known sources)
    - ▶ Cryptographic Authentication (Certificates - similar to email)

Limitations of FIX:

▶ Complexity:
  ▶ Different versions of FIX may be incompatible,
  ▶ Custom fields can be tricky to implement and account for,

▶ Latency:
  ▶ Parsing ascii messages is expensive,
  ▶ Not recommended for high frequency trading (HTF),

▶ Security:
  ▶ Inbuilt session level security is not sufficient,
  ▶ Should ideally be used over TLS/SSL, (FIXS)

▶ Robustness:
  ▶ Hard to catch and handle errors effectively,

▶ Integration:
  ▶ Integration with other systems is hard, especially legacy ones

Messaging Systems:
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Messaging Protocol (FIX):
oooo

FIX Example:
●ooooooo

Market Manipulation Using Messaging Services:
oooooo

Addendum:
oooo

Topic

Messaging Systems:

Messaging Protocol (FIX):

FIX Example:

Market Manipulation Using Messaging Services:

Addendum:

Logon

This is an example **Logon** message to establish a **FIX Session**

```
8=FIX.4.2 9=134 35=A 49=SENDER_ID 56=TARGET_ID 34=1
52=TIME 98=0 108=30 96=SESSION_PASSWORD 10=141
```

Tags (or keys) are denoted with a number some i.e:

- ▶ 8 = Fix Version,
- ▶ 9 = Body Length
- ▶ 35 = Message Type (A for logon)
- ▶ 34 = Message Number in the Session
- ▶ 108 = Heatbeat interval
- ▶ 10 = checksum
- ▶ 98 = Encryption Method (0 for none)
- ▶ 108 = Heatbeat Interval,
- ▶ 10 = Checksum

Server Response:

```
8=FIX.4.2 9=91 35=A 49=TARGET_ID 56=SENDER_ID 34=2
52=TIME 98=0 108=30 10=209
```

▶ A server would respond with a 35=A (Logon) message (34=2, this is the second
  message in the session) to acknowledge the logon request and start the session.

Heartbeat:

```
8=FIX.4.2 9=49 35=0 49=SENDER_ID 56=TARGET_ID 34=3
52=TIME 10=238
```

- ▶ To maintain the session a heartbeat must be sent,
- ▶ This is done using 35=0, so the message type is a heartbeat.
- ▶ This heartbeat must be sent at the established intervals. (108)

Quote Request:

```
8=FIX.4.2 9=81 35=R 49=SENDER_ID 56=TARGET_ID 34=4
52=TIME 55=AAPL 262=QUOTE_REQ_ID 10=042
```

► This is an example of getting a quote for Apple (AAPL),
► Note:
  ► 35=R (Quote Request),
  ► 55=AAPL (Ticker to Get a Quote for),
  ► 262=Quote Request ID,

Server Response To Quote Request:

```
8=FIX.4.2 9=126 35=S 49=TARGET_ID 56=SENDER_ID 34=5
52=TIME 55=AAPL 132=0 133=123.45 134=100 262=QUOTE_REQ_ID 10=212
```

- ▶ The server will respond with a **Quote** (35=S) for the **Quote Request**
- ▶ Note:
    - ▶ 132=0 (Quote Condition, 0 for regular, 8 for Open, 9 for Close etc)
    - ▶ 133=123.45 (Price!),
    - ▶ 134=100, (Offer Size),
- ▶ From this we now know that 100 shares of apple is quoted at 123.45.

Buying Apple Stocks:

```
8=FIX.4.2 9=123 35=D 49=SENDER_ID 56=TARGET_COMP_ID 34=6
52=TIME 55=AAPL 54=1 38=100 40=2 44=125.00 59=0 10=212
```

- ▶ This is
  - ▶ **an (1) order** (35=D)
  - ▶ to **buy** (54=1)
  - ▶ **100** (38=100)
  - ▶ shares of **AAPL** (55=AAPL)
  - ▶ with a **limit** (40=2) **price of 125** (44=125.00)

Messaging Systems:
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Messaging Protocol (FIX):
0000

FIX Example:
0000000●

Market Manipulation Using Messaging Services:
000000

Addendum:
0000

Server Response:

```
8=FIX.4.2 9=115 35=8 49=TARGET_ID 56=SENDER_ID 34=7
52=TIME 37=ORDER_ID 17=EXEC_ID 150=0 39=0 55=AAPL 54=1 38=100
44=125.00 32=0 31=0.00 10=241
```

▶ Note:
   ▶ 32=0 (last shares - number of shares traded since last order status query)
   ▶ 31=0 (price at which the last batch of shares was transacted at)
   ▶ As nothing has been executed just yet - these are both 0.

Topic

Messaging Systems:

Messaging Protocol (FIX):

FIX Example:

Market Manipulation Using Messaging Services:

Addendum:

Order Spoofing:

Placing large orders with no intention of executing them to create the illusion of market pressure - changing the price of a security.

- ▶ Messaging Systems allow for fast placement and cancellation of orders,
- ▶ Due to the increased volume of trades messaging systems provide - there is a greater level of anonymity,
- ▶ However it is easier to detect potential attempts at order spoofing,
- ▶ Regulations surrounding order spoofing are much tighter with more severe reprimands since the adoption of electronic messaging systems.

Example: Michael Coscia (Fined $1.4mm)
Example: Navinder Singh Sarao (Fined $12.8mm)

Order Layering:

Placing large orders at various price points with no intention of executing them to create the illusion of market depth - influencing the price of a security.

▶ Messaging systems allow for such orders to be quickly placed and canceled,

▶ Automation of order layering is fairly easy to achieve with computer,

▶ Orders can be distributed across platforms to increase anonymity,

Quote Stuffing:

A large number of orders are placed and very quickly canceled causing delays in legitimate trades and creating the illusion of either volatility or a sudden interest in a security.

- ► Often used in high frequency trading,
- ► Aims to trick and deceive other traders' judgement of current market conditions,
- ► May confuse automated trading systems causing undefined or unexpected behaviour.

Dark Pools:

Dark Pools are a type of privately organised trading pool

▶ Large amounts of a security can be traded without affecting the market,

▶ Provide something called **Dark Liquidity** (the ability to privately trade a security without impacting its immediate price).

▶ Trades within the dark pool are not publicly disclosed in real time,

▶ Vulnerable to market manipulation due to:
  ▶ Some dark pool operators may prioritise certain members more,
  ▶ Predatory Trading:
    ▶ HFTs can detect large trades made in dark pools and trade against them in public markets,
  ▶ Taking advantage of the delayed disclosure to trade before a large trade is publicly disclosed.

Messaging Systems:
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Messaging Protocol (FIX):
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FIX Example:
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Market Manipulation Using Messaging Services:
000000●

Addendum:
0000

Algorithmic Trading vs Humans:

With the rise of electronic trading came the rise of high frequency trading (HFT)

▶ HFTs can out perform human traders in highly volatile markets,

▶ HFTs are much faster to react to market conditions,

▶ Due to the sheer volume of trades, HFTs have a huge short term market impact,

	Human	Algorithm
Holding Time	mins/hours	< 1 second
Volume	Few trades	Massive number of trades
Market Impact	Long term	Short term
Judgement	Emotional and Biased	Quantitative

Topic

Messaging Systems:

Messaging Protocol (FIX):

FIX Example:

Market Manipulation Using Messaging Services:

Addendum:

Messaging Systems:
000000

Messaging Protocol (FIX):
0000

FIX Example:
00000000

Market Manipulation Using Messaging Services:
000000

Addendum:
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Glossary:

Term	Definition
Exchange	Place where securities are publicly listed
Market Maker	Provides liquidity by organising the sale of securities
Security	A tradable asset (Stock, Bond, Contract, Currency, etc)
Liquidity	The ability to trade a security without impacting it's price.
Order	A request to buy or sell a security
Inter-Dealer Brokers	Facilitate trades between investment banks and broker-dealers
Broker-dealers	Facilitates trades, provides quotes and liquidity
Match	To find a complimentary order based on order type
ECN	An Electronic Communication Network uses systems to match orders
Dark Pool	A dark pool is a private and anonymous trading pool
Trading Pool	A group of investors who collaborate to trade securities

FIX TAGS:

Tag	Meaning
8	FIX protocol version definition
9	Message Body Length
35	Message Type
49	Server's Component ID
56	Sender's Component ID
34	Message Sequence Number
52	Sending Time
98	Encryption Method
108	Heartbeat Interval (Seconds)
10	Checksum
55	Ticker
262	Quote Request ID
133	Offer Price
134	Offer Size

Feedback:

Messaging & Market
Manipulation: Feedback Form