FIX Protocol

mthree Alumni Training

FIX – Financial Information eXchange

Objectives

- This course will give you a high-level overview of FIX protocol and how it is used in trading.

- An example fix message: You will be able to read this by the end of this lesson.

- **8=FIX4.2|9=0132|35=D|57=ADMIN|34=2|49=TESTA|56=TESTB|52=20100315-13:45:28|55=BARC|40=2|38=1000|21=2|11=OrderNumber0|60=2010031517:45:20|54=1|44=110.5|10=9**

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FIX

FIX – Financial Information eXchange – an industry-driven messaging standard for the exchange of trading-related information between financial institutions.

- Supports pre-trade, trade and post-trade messaging
- Used by financial institutions like broker-dealers, exchanges, institutional investors, and others in industry to communicate with each other
- Platform independent: works with various types of computers and communication systems
- Open free protocol that can be used by anybody
- Flexible and customizable

The FIX Trading website is the central point of reference and communication for all things FIX – FixTrading.org

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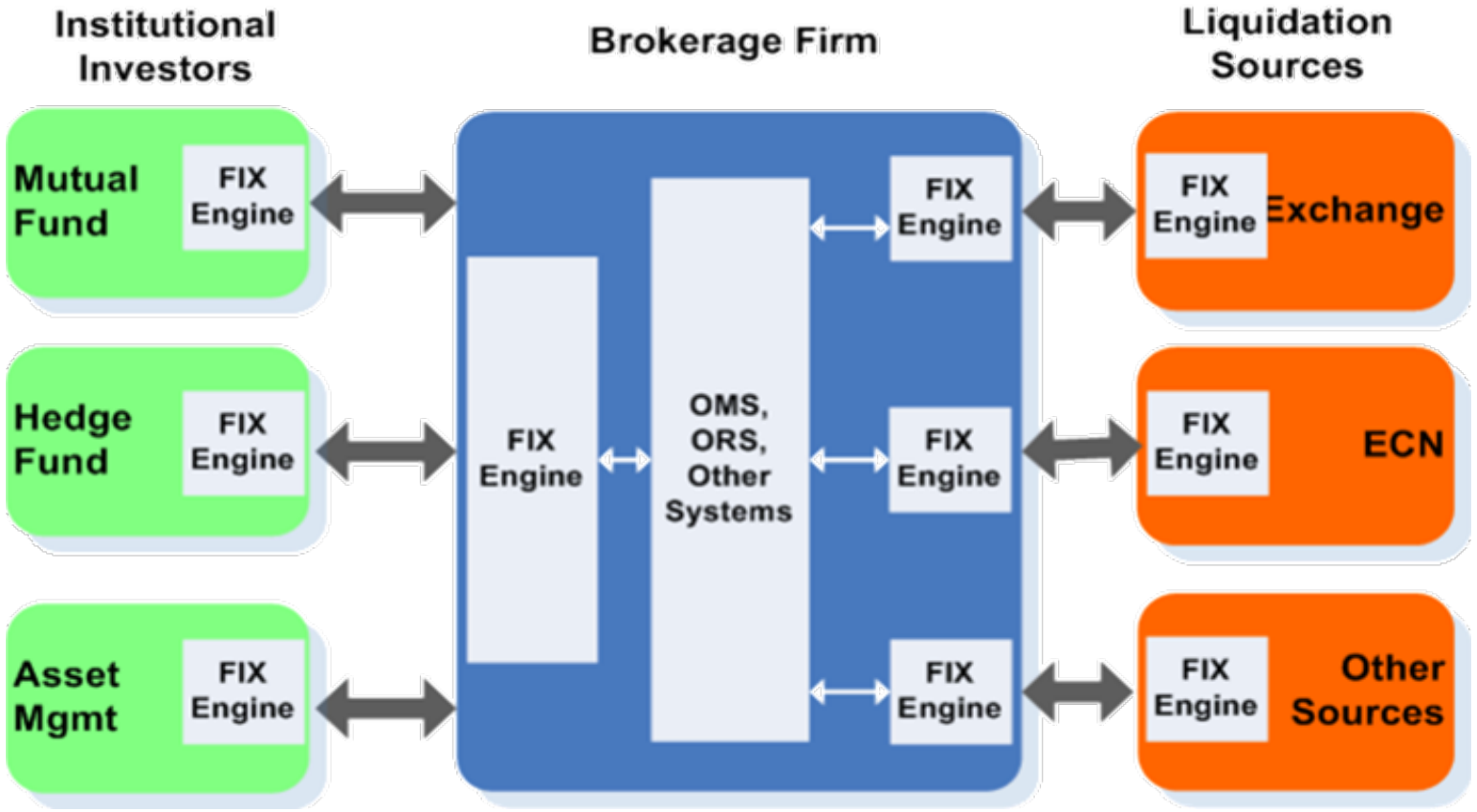
How FIX Works

- Example trading system to show how FIX is used.



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FIX Messages

- A FIX message is divided up into three parts:
  - **Header**: contains administrative information about the message – who sent the message, who the message is going to, what time it was sent.
  - **Body**: contains the actual financial information – fields like Symbol, Shares, Price.
  - **Trailer**: usually there is only one field set in here – the Checksum for the message – to ensure message integrity.
- There are two main message types:
  - **Session-level messages** - negotiating a connection (login, logoff and resend requests)
  - **Application messages** - financial messages (e.g., new trading order)
- The FIX protocol itself specifies hundreds of different tags.
- In each message, you will see the tag number and value as a pair: e.g. , 55=AAPL;

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FIX Message Header

Each administrative or application message is preceded by a standard header. The header identifies the message type, length, destination, sequence number, origination point and time.

- Who sent the message
- Who the message was sent to
- Which trader sent the message (if applicable)
- What version of FIX is used in the message
- What message type is being sent
- Where the message is to be routed to (if applicable)

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FIX Session-Layer Messages

- Session-level messages allow applications to establish and maintain connection with each other. Once a FIX connection is established, it will start sending the following messages:

Logon (35=A)	• Message authenticates a user establishing a connection to a remote system – must be the first message sent by the application to initiate a fix session
Heartbeats (35=0) /Test Requests (35=1)	• Keep-alive messages used to detect network connectivity issues during slow message traffic periods
Resend Requests (35=2)	• Used to request missed messages after detecting a gap
Sequence Reset (35=4)	• Message is used to reset the incoming sequence number on the opposing side
Reject (35=3)	• Message indicating a serious error that may be the result of faulty logic in either the sending or receiving application
Logout (35=5)	• Message to logout of session – nothing should be sent further unless a resent request comes in

FIX Sequence Numbers

- In tag 34, the FIX protocol also specifies the use of sequence numbers in the session layer for all FIX Messages.
  - A unique identifier for each incoming and outgoing message.
  - Used by the FIX engine to keep track of how many messages have come in and gone out (incrementing number)
  - On a normal day, sequence numbers will start at 1
  - Sequence numbers are unique for each connection
  - Resetting sequence numbers during the middle of the trading day can cause major issues and should only be done with care. (This will effectively wipe out knowledge of the whole day's worth of trading)
  - If a sequence number is missed, the counterparty sends a resend request asking for that data.

FIX Message Body

- The body of a FIX message contains the actual financial information that will be important to the receiver of the message.
- Important fields that would be in the body of a FIX Order message tags are:
  - 55 = Symbol - Security Ticker
  - 11 = ClOrdID - Client Order ID
  - 38 = Order Quantity
  - 40 = Order Type Limit\Market
  - 44 = Price – This value would only be present on Limit Order indicated by tag 40
  - 54 = Side – Buy\Sell
  - 21 = Handle Instructions – Instructions for order handling at broker
  - 59 = Time In Force – When the order will expire. Note: if this value is not present, it is assumed the order is for the day only.

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FIX Message Trailer

- The trailer of a FIX message usually contains only one field – tag 10, the checksum.
- The checksum in a FIX message provides a simple message integrity check. The checksum is the sum of all the binary values in them message.
  E.g., 10 = 193
- Upon receiving a message, a FIX engine will compute the checksum of the message and make sure it matches the checksum in the actual message; this helps to identify transmission problems.
- For transmission, the checksum must be sent as printable characters, so the checksum is transformed into three ASCII digits.

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How to connect a FIX session

- There is a strict protocol followed to connect two FIX engines:
  - The side that has agreed to initiate the connection (the Initiator) first makes a socket connection to the counterparty's FIX engine and then sends a FIX Logon message.
  - Upon receiving that FIX Logon message, the Acceptor counterparty must acknowledge that FIX Logon message with its own FIX Logon acknowledgement message (ack).
  - Once the ack has been received, the connection has been established and trading can begin.

8=FIX.4.2^9=0060^35=A^34=1^49=MS^56=UBS^52=2018031514:58:07^98=0^108=30^10=0015

MS ---------

8=FIX.4.2^9=0060^35=A^34=1^49=UBS^56=MS^52=20180315-14:58:08^98=0^108=30^10=0016

---------- UBS

Message Type Codes

Message type (tag 35) is one of the most important fix tags used; not all of these may be supported by financial institutions.

Tag Code	Meaning	Tag Code	Meaning	Tag Code	Meaning
A	Logon	J	Allocation	4	Sequence Reset
B	News	K	List Cancel Request	5	Logout
C	Email	L	List Execute	6	Indication of Interest
D	New Order Single	M	List Status Request	7	Advertisement
E	New Order List	0	Heartbeat	8	Execution Report
F	Order Cancel Request	1	Test Request	9	Order Cancel Reject
G	Order Cancel/Replace Request	2	Resend Request		
H	Order Status Request	3	Reject		

Example New Order Message

Here is an example new order fix message:

8=FIX4.2|9=0132|35=D|57=ADMIN|34=2|49=TESTA|56=TESTB|52=20100315-13:45:28|55=BARC|40=2|38=1000|21=2|11=OrderNumber0|60=2010031517:45:20|54=1|44=110.5|10=9

FIX Logs	Tag Description
35=D	(MsgType = D / Order)
49=TESTA	(SenderCompID = TESTA)
56=TESTB	(TargetCompID = TESTB)
55=BARC	(Symbol = BARC)
40=2	(OrdType = 2 Limit)
38=2000	(OrderQty = 2000)
11=OrderNumber0	(ClOrdID = OrderNumberO)
44=110.5	(Price = 110.5)
54=1	(Side = 1 / Buy)

FIX Execution Reports

FIX execution reports are sent by the recipient (Broker/Exchange) who is managing the order.

- Confirm the receipt of an order
- Confirm changes to an existing order (in response to order cancel request, etc.)
  - Relay order status information
  - Reject orders
  - Relay Fill (execution) information, etc.

Each execution report contains three fields which are used to communicate both the current state of the order as understood by the broker and the purpose of the message:

OrdStatus <39>, ExecType <150> and ExecTransType <20>.

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Execution Report Messages

Execution transaction type (tag 20) indicates the type of transaction:

Tag Code	Meaning
0	New order acknowledgement
1	Cancel previously reported execution due to error, etc.
2	Correction to the previously reported execution.
3	Reports the status of the orders

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Execution Type

ExecType (150) field describes the specific Execution Report (i.e., Pending Cancel) while Order Status <39>, will always identify the current order status (i.e., Partially Filled).

Tag Code	Meaning	Tag Code	Meaning
0	New	8	Rejected
1	Partial Fill	9	Suspended
2	Fill	A	Pending New
3	Done for Day	B	Calculated
4	Cancelled	C	Expired
5	Replace	D	Restated
6	Pending Cancel	E	Pending Replace
7	Stopped Set		

Order Status

Identifies current status of order. **OrdStatus <39>** - sent by the counterparty on an acknowledgement message.

Tag Code	Meaning	Tag Code	Meaning
0	New	8	Rejected
1	Partial Fill	9	Suspended
2	Filled	A	Pending New
3	Done for Day	B	Calculated
4	Cancelled	C	Expired
5	Replace	D	Accepted for
6	Pending Cancel	E	Pending Replace
7	Stopped Cancel/Replace Request		

Execution Report – Other Values

OrderID (tag 37) - unique identifier for this order as assigned by the Sell Side - this is how the sell side keeps track of the orders that it is executing

ExecID (tag 17) - unique ID for each execution report. Note the difference between order ID - one order (with Order ID "Order1") might have multiple execution reports, each with own ExecID, but the same OrderID.

LastShares (tag 32) - the number of shares that were filled by this Execution Report

LastPx (tag 31) - the price at which the shares in this particular execution report were filled at

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Execution Report – Other Values

AvgPx (tag 6) - calculated average price of all fills on this order.

CumQty (tag 14) - total number of shares filled by all execution reports at this point

LeavesQty (tag 151) - amount of shares available for further execution.

Symbol, Side & OrderQty, are used in the same manner as in the Order Message. In the execution reports sent back for the order, these fields must match the values that were in the original Order message.

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Example FIX Messages

Order / Acknowledgement

FIX Logs	Tag Description
35=8	MsgType=8/Execution Report
39=0	OrdStatus=0INew
150=0	ExecType=0/New
20=0	ExecTransType=0/New
17=63187159	ExecID = 63187159
37=63089743	OrderID = 63089743
14=0	CumQty = 0
151=2000	LeavesQty = 2000
31=0.0	LastPx = 0.0
32=0	LastShares = 0
6=0.0	AvgPx=0

Order Partially Filled

FIX Logs	Tag Description
39=1	OrdStatus=1/Partial Fill
150=1	ExecType=1/Partial Fill
20=0	ExecTransType=0INew
17=63187160	ExecID=63187160
14=1000	CumQty=1000
151=1000	LeavesQty=1000
31=110.5	LastPx=110.5
32=1000	LastShares=1000
6=110.5	AvgPx=110.5

Order Filled

FIX Logs	Tag Description
39=2	OrdStatus=2IFill
150=2	ExecType=2IFill
20=0	ExecTransType=0INew
17=63187161	ExecID=63187161
14=2000	CumQty=2000
151=0	LeavesQty=0
31=110.375	LastPx=110.375
32=1000	LastShares=1000
6=110.4375	AvgPx=110.4375

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FIX Message Order Flow Example

New Order to Buy 20 Shares in Vodafone limit Price 110

8=FIX.4.2^9=0138^35=D^57=CASH_DESK^34=2^49=MTHREE^56=UBS^52=20180318-11:16:56^55=VOD^40=2^38=20^21=2^11=Order_M1^60=20180318-11:16:58^ 54=1^44=110^10=252

Order Acknowledgment By Broker

8=FI X.4.2^9=0214^35=8^50=TRADER_ID^34=2^49=UBS^56=MTHREE^52=20180318-11:17:00^151=20^55=VOD^40=2^11=Order_M1^31=0^150=0^39=0^54=1^44=110.5^32=0^
^17=6941651^38=20^21=3^60=20180318-11:17:00^6=0^20=0^14=0^37=Broker_ID^10=200

Partial Fill of the Order Sent By Broker

8=FIX.4.2^9=0222^35=8^50=TRADER_ID^34=3^49=UBS^56=MTHREE^52=20180318-11:33:11^151=10^55=VOD^40=2^11=Order_M1^31=110^150=1^39=1^54=1^44=110^32=10^31=110^
17=63187160^38=20^21=3^60=20180318-11:33^6=110^20=0^14=10^37= Broker_ID ^10=140

Client Issuing Cancel Order Request to Broker

8=FIX.4.2^9=0141^35=F^57=CASH_DESK^34=3^49=MTHREE^56=UBS^52=20180318-11:40:02^41=
Order1^55=VOD^38=20^11=Order_M3_CANCEL^41 = Order_M1^60=20180318-11:40:03^54=1^10=052

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FIX Message Order Flow Example

Order Pending with Broker to be Cancelled

8=FIX.4.2^9=0230^35=8^50=TRADER_ID^34=4^49=MTHREE^56=UBS^52=20180318-11:41:05^151=10^55=VOD^11=Order_M3_CANCEL^31=0^150=6^39=6^54=1^44=110^17=69416^32=0^41=Order_M1^38=20^60=20180318-11: 41:05^6=0.0 20=0^14=10^37=Broker_ID ^10=025

Broker Acknowledgment Accepted Order Cancelled

8=FIX.4.2^9=0221^35=8^50=TRADER_ID^34=4^49=UBS^56=MTHREE^52=20180318-11:41:05^151=10^55=VOD^11= Order_M3_CANCEL^31=0^150=4^39=4^54=1^17=69416^32=0^41= Order_M1^38=20^60=20180318-11:41:05^6=0^20=0^14=10^37=Broker_ID ^10=124

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Order Cancel Reject (35=9)

- The Order Cancel Reject <9> message is issued by the broker upon receipt of a cancel request or cancel/replace request message which cannot be honored.
- Requests to change price or decrease quantity are executed only when an outstanding quantity exists.
- Filled orders cannot be changed (i.e., quantity reduced or price change). However, the broker/sell side may support increasing the order quantity on a currently filled order).
- When rejecting a Cancel/Replace Request, the Cancel Reject <3> message should provide the ClOrdID <11> and OrigClOrdID <41> values which were specified on the Cancel/Replace Request message for identification.
- The execution message responds to accepted cancel request and cancel/replace request FIX messages.

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The Don’t Know Trade Message (35=Q)

- The Don't Know Trade <Q> (DK) message notifies a trading partner that an electronically received execution has been rejected. This message can be thought of as an execution Reject <3> message.
- This message has special utility when dealing with one-way execution reporting. If the initial Order Acknowledgment message (LastShares <32>=0 and OrdStatus <39>=New) does not match an existing order, this message can be used to notify the broker of a potential problem order.
- Note that the decision to DK an execution lies with the institution. Some of the mismatches listed in the DKReason <127> field may be acceptable and will not require a DK message to be generated.
- Key FIX Tag ExecID <17> to point out which Execution Report that the client has DK’d this would confirm which Partial fill they have not accepted or even the order.

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FIX – Reject Messages (35=3)

- FIX provides a mechanism that allows a FIX engine to reject an invalid message. A message could be rejected for one of many possible reasons, including:
  - The message is garbled or corrupted.
  - The message does not pass the integrity check based upon the Checksum field in the trailer.
  - A required field in the message is missing. (For example, if I received an Order with no Symbol field set.)
  - A message with an improperly formatted field. (For example, if I received an Order with an Order Quantity field set with a non-numeric value.)
- The text field tag 58 usually contains the reject reason.

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IOI – Indication of Interest (tag 6)

- Indication of interest messages market merchandise which the broker is buying or selling in either a proprietary or agency capacity. These are usually time-sensitive offers that are sent to a large number of clients; as such, a response is needed quickly.
- The key fix tags needed for an IOI include:

Tag Code	Value/Meaning	Tag Code	Value/Meaning
35	6	54	Side
27	IOIShares	55	Symbol
23	Unique identifier of IOI Message	28	IOITransType Values
N	New	C	Cancel
R	Replace		

FIX Message IOI Example

Message indicates a buyer for a 100 shares of BNP Paribas SA

8=FIX.4.2^9=198^35=6^34=5^49=UBS^52=20181005-14:34:35^56=MTHREE^15=EUR^22=5^23=I15850
^27=100^28=N^44=15.5^48=BNPP.PA^54=1^55=BNP^62=20181005-15:04:35.677^107=BNP Paribas SA
^130=Y^10=036

Response IOI - New Order Sent by Client

8=FIX.4.2^9=137^35=DZ^34=8^49=MTHREE^52=20181005- 14:35:46.672^56=UBS^11=1223217346597
^21=1^38=100^40=1^54=2^55=BNP ^59=0^60=20181005-14:35:46.668^10=153

Order Acknowledgment

8=FIX.4.2^9=177^35=8^34=9^49=UBS^52=20181005-14:36:07^56=MTHREE^6=0
^11=1223217346597^14=0^17=E1223217367463^20=0^31=0^32=0^37=O1223217347023^38=100^39=0^54=2
^55=BNP^150=0151=100^10 =164

Completed Filled Order

8=FIX.4.2^9=189^35=8^34=11^49=UBS^52=20181005-14:36:43.201^56=MTHREE^6=15.5^
11=1223217346597^14=100^17=E12232173738^20=0^31=15.5^32=100^37=O1223217347023^
38=100^39=2^54=2^55=BNP^150 =2^151=0^10=237

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Useful Websites

- FIX Trading Community
- Global Trading
- Wikipedia: Financial Information eXchange
- FIXimate FIX Interactive Message And Tag Explorer

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