FIX PROTOCOL: THE BACKBONE OF FINANCIAL TRADING

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ABSTRACT

The Financial Information exchange, commonly known as the FIX protocol, is a key component in the trading market infrastructure. Hence, this paper delivers a clear background on the FIX protocol: its structure, role, and its importance in the financial markets space. In this paper, we look at the background and development of the FIX protocol as well as the functions and usefulness of this protocol in the conducting of trading electronically. Sect. 2 from the literature survey of various studies and application of the FIX protocol in conjunction with distinct financial markets. The 'Methodology' subchapter explains how this FIX protocol functions practically at the level of messages' formatting, sessions' employing, and an application of data protection measures. Last of all, the conclusion and recommendation, as well as findings on the effects of FIX protocol on trading efficiency, market transparency, and such costs, are also provided. The conclusion provides a brief resume of the papers and notes the outlook of the implication of the FIX protocol considering the ever-expanding digital frontiers in the financial sector.

KEYWORDS

FIX protocol, Financial Trading, Standardization, Electronic Trading, Efficiency.

1. INTRODUCTION

Over the past few decades, the financial markets have changed from paper based floor trading to today's high-powered electronic systems. This shift in processes required the implementation of protocols also to standardize their means of communication to facilitate reliable and smooth transactions among the various participants in a market. The Financial Information Exchange (FIX) protocol, the following emerged as a STANDARD to this NEED. FIX protocol is used to carry out billions of trades per day.

1.1. The Evolution of Financial Trading

1.1.1. Open Outcry System

Outdated technique that held the past efficient degree of trading was performed on the floor with certain traders buying and selling a trading floor packed with traders who provide indications of buy and selling using their voice and hand signs
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1.1.2. Introduction of Electronic Trading Systems

First change from paper to entry whereby it was possible to key in the orders and the possibility of effecting trades in the Market electronically.

1.1.3. Development of Early Communication Protocols

First use of different application-specific protocols to connect different trading environments.

1.1.4. Advent of Internet and Online Trading Platforms

As a result of going or rather being propelled by technology, especially the innovation of the internet and online technologies the access of the traders to place orders has been improved.

1.1.5. Fragmentation of Markets

People trading in multiple trading floors, firms and platforms necesiates communication standard.
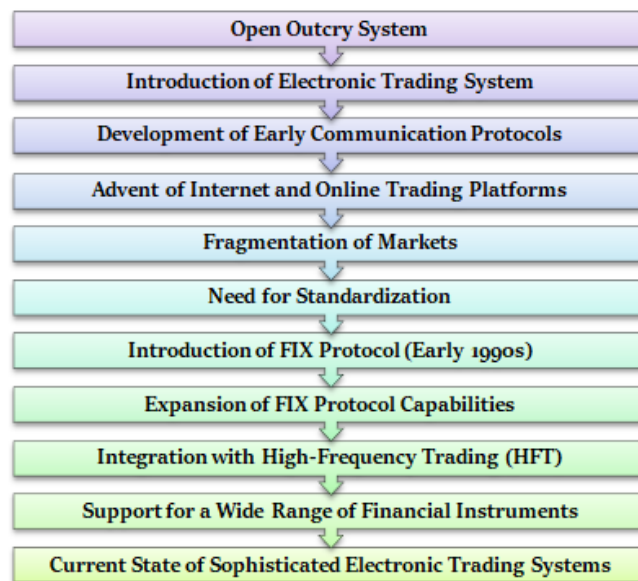

Figure 1. The Evolution of Financial Trading

1.1.6. Need for Standardization

Having mercy on the fact that there is sounding a call for a protocol through which efficient communication is feasible, thus a way through which trading systems may be connected in a manner that the established structures are not violated.

1.1.7. Introduction of FIX Protocol (Early 1990s)

There is a specialized published message specification known as FIX Protocol. M & M also use the FIX Protocol as a software program that was published as a standard message specification known as the FIX Protocol. Creation and practice of the methods for the improvement of the transactions-related information exchange through formulation and launch of the Financial Information exchange (FIX) protocol.

1.1.8. Expansion of FIX Protocol Capabilities

It assumes that every premise should improve the application of the FIX protocol to each phase of the trading life cycle and all kinds of instruments.

1.1.9. Integration with High-Frequency Trading (HFT)

FIX protocol support high speed transaction processing with very small elapsed time.

1.1.10. Supports diverse Financial Asset Classes

Increased stock, bond, and floating rate note business, foreign exchange, and other equities, securities, and derivative products utilizing the FIX protocol.

1.1.11. Current State of Sophisticated Electronic Trading Systems

For the purpose of this work, today's trading can be characterized as somewhat fast and further characterized by high coupling and conversion processes that are in Relation to the FIX protocol for exchanging information.

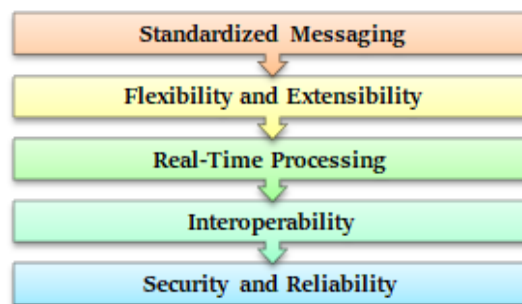## 1.2. Key Features of FIX Protocol

Figure 2. Key Features of FIX Protocol

1.2.1. Standardized Messaging

The message type of FIX messages is very much structured this is accomplished in a way to synchronize the communication with the trading platforms and the participants. The so-mentioned message is compiled from fields or, as the scientists refer to such elements, key data, which point to specific aspects concerning a trade.

1.2.2. Flexibility and Extensibility

The specifics of the FIX protocol can be flexibility or extensibility in order that it can meet new requirements on the markets and can meet the requirements on the differences of securities kinds. Therefore, the options of creating new message types and new fields at any given time are always open to address the shift in trading activities of interacting partners and the integration of new technologies.

1.2.3. Real-Time Processing

Specific to the type of messages in issue; FIX messages – they are designed for real-time processing and therefore afford the swift and efficient interchange as well as reception of trade related information. These capabilities are of significant importance when engaging in trading within the HFTs and the other strategies that entail the immediate execution of the orders.

1.2.4. Interoperability

This is something like that because FIX is a protocol that acts more like a language of trading systems/platforms in trades distinctively. Thus, it assists in decreasing the costs of other participants within the market integrating, as pointed out in this interoperability.

1.2.5. Security and Reliability

There are also provisions for Security as well as for Guaranteeing the manner that which the messages are to be passed through the FIX protocol.

1.3. Applications of FIX Protocol

The FIX protocol is widely used across various segments of the financial industry [7], including. It has become the norm for a cross-section of the financial industry segments that include but are not limited to:

- Equities Trading: This has made it play a central role regarding the provision of order and execution details of stock transactions.
- Fixed Income Trading: Slope with trading of bonds and other fixed income which are of debt securities.
- Foreign Exchange (FX) Trading: Applied in performing activities related to the currency business using information exchange via electronic media.
- Derivatives Trading: Provides in the negotiation of the options, future, and other derivative securities.
- Post-Trade Processing: It is highly related to the confirmation of the trades and the distribution and settling of the trades which takes place between the buyer and the seller.

1.4. Importance of "Introduction to FIX Protocol: The Backbone of Financial Trading"

1.4.1. Standardization and Interoperability

- Unified Language: In the trading environment FIX provides for the need for a standard language that unites all the variety of trading systems and applications. This integration of a standard form is required because the existing formats specific to particular software applications are eliminated, which can contribute to errors and misinterpretation.
- Cross-Platform Integration: As an application protocol, FIX also comes in useful in such a way that trading systems that participate in the market get to interact, hence improving the connectivity and efficiency of the financial institutions. This has the impact of producing liaison and enhancement of the course of logistics between the global markets.

1.4.2. Efficiency and Speed

- Real-Time Trading: FIX is aimed at real-time processing; this makes it easier to display, send, or transmit orders or executions and confirmations. Speed is important in many strategies, including fast trading, widely known as high-frequency trading.
- Reduced Latency: Since the time taken to exchange trade details is cut, through this protocol, efficiency is enhanced. Reduction of such latencies is crucial, especially in trading since the trading domains often may be characterized by a lot of competition.

1.4.3. Cost Reduction

- Lower Transaction Costs: Even through the centralization of communication and the slashing out of many functions by proprietary systems, the transaction costs are reduced by the FIX protocol. This is beneficial for the two parties that are the financial institutions and the clients since a reduction in cost is always positive.
- Operational Efficiency: These factors prove that through standardization, there is the possibility of a reduction of the overall costs and time when it comes to the maintenance and integration of heterogeneous systems. That is, the progress opens up the possibility of accomplishing operation efficiency in financial firms to reduce costs and increase profitability.

1.4.4. Enhanced Security and Reliability

- Secure Transmission: Contrary to ADP, the centrality of FIX is trade information, and therefore, it contains security features that enhance its privacy and accuracy. Such measures assist in ensuring that access is granted only to authorized personnel or that confidential data is not accessed by unscrupulous people.
- Reliability: During the designing of the protocol, message delivery is made reliable in order to keep confidence in electronic trading. This reliability keeps off interferences to the overall market operations, enhancing them.

1.4.5. Adaptability and Extensibility

- Evolving Markets: The FIX protocol is very open and has the needed flexibility to add new instruments and existing strategies in the financial market. This adaptability helps ensure that the protocol will remain useful when new markets come up or with the introduction of new technologies.
- Customizable: One distinctive characteristic of FIX is that financial institutions can add new fields; moreover, new messages can also be introduced as necessary. To this extent, specific requirements for trading can be met with great versatility due to the extensibility of the proposed solutions.

1.4.6. Broad Industry Adoption

- Global Standard: For the rationale of this paper, FIX is well-known and implemented in the global financial domain. Due to the current global adoption, mastering it is crucial for relevant workers in trading, risk management, compliance, and IT departments.
- Collaboration and Innovation: As a result of high levels of recognition, there are cooperative advances within the market participants that improve practices in electronic trading. This collaboration makes the industry progress and pushes for new innovations to be made.

2. LITERATURE SURVEY

2.1. Historical Background of the Fix Protocol

Originally, FIX protocol was developed in the early 1990s when Salomon Brothers and Fidelity Investments established this model to facilitate brokers' communication with their clients. [8] Its main objective was to define a unified method of electronic messaging in the field of finance. Fix

Protocol, through the years has evolved to different versions with different modes and possibilities because of the enhancements of the need for the overall financial market.

2.1.1. Key Milestones in FIX Protocol Evolution

- Version 1. 0 (1992): The first was issued in September 1994, was only provided for equity trading, and was largely used for order purposes.
- Version 2. 0 (1995): Chamberlin implemented support to fixed income securities to which the assistance of the protocol expanded its coverage.
- Version 4. 0 (1998): Changes made were extending support to derivatives and trading of forex.
- Version 5. 0 (2006): Significant improvements noted to enforce data security; upgrades made to the approach of message handling.
- Version 5. 0 Service Pack 2 (2010): Additional improvements concerning the sessions' management and the new types of messages which can be utilized in order to address the regulation requirements.

2.1.2. Adoptions & the Industry

The adoption of the FIX protocol has resulted in stable means of communication. Observations in ascertaining the literature also reveal that usage in advancement has been marked in a chronological manner, including acceptance by bankers and authorities.

- Adoption by Major Exchanges: By the time of around early 2000, most of the exchanges, starting from NYSE to NASDAQ, had integrated the FIX protocol into the electronic trading business.
- Regulatory Endorsements: Proper Protocol has been welcomed by financial Firms and regulatory bodies.

2.2. Major characteristics of FIX Protocol

There is a vast amount of literature that explores the FIX protocol and mostly discusses its three pivotal components: messages, sessions, and security. These features are so important to the reliability and security of the communication done on the trading systems.

2.2.1. Message Structure

As for the format of the messages, it uses tag-value pairs like; for instance, the tag is a fixed name of the field, and the value is data related to the field. The format of this type of message enables all the participating trading systems to correspond in a standard and precise manner.

- Common Message Types: These are New Order Single, Execution report, and Order cancel request.
- Message Encoding: Messages are in ASCII to enable simple processing by the trading systems of the message passed between business partners.

2.2.2. Session Management

In the FIX protocol, session management entails initiation, sustainment or any form of communication between trading systems. This process makes sure that messages are delivered on time without dropping some and also in the right order.

- Session Initiation: In the case of ISDN, the Logon message is sent to create a session with another party.
- Heartbeat Messages: XHM messages, especially the heartbeat messages, are sent periodically to sustain the session.
- Sequence Number Management: Every message within a session is given a sequence number to ensure messages delivered in the right order, and the absence of a message can be identified.

2.2.3. Data Security

Data security is an essential component of the FIX protocol. There is always the protection of the trading systems' messages by trying to ensure the exchange integrity and anonymity of the messages through different encryption and authentication methods.

- Encryption: Secure Socket Layer (SSL) or its improved version, Transport Layer Security (TLS), can be used to provide message-level encryption to the FIX messages while in transit.
- Authentication: It should be noted that authorizations to access FIX sessions can also be provided using the username and password which means that only those who are allowed in the FIX communication are allowed to do so.

2.3. Some of the Applications of the Different Financial Markets

This particular protocol that has been described herein by the name FIX has been welcomed in different kinds of financial markets such as equities, fixed incomes, derivatives, and even foreign exchange markets.

2.3.1. Equities

In equities markets specifically, there are certain areas that the FIX protocol is used, and these are in order management, trade execution, and post-trade. It aids in real-time communication between brokers, exchanges, and institutional investors, meaning that it increases the efficiency of the trade execution.

2.3.2. Fixed Income

It has established high usage in the fixed income via bonds as well as the electronically traded fixed income instruments. These functions more as an encipherment, which outlines procedures regarding how to cite, trade, and announce fixed-income securities.

2.3.3. Derivatives

FIX works effectively for trading in many over-the-counter derivative instruments, for instance, call options, future contracts, and swaps. The communication model assists in the transmission of complex messages within the derivatives trading activity, for example, the type of order, price quote, and the respective risk management parameters.

2.3.4. Foreign Exchange

In the foreign exchange market, FIX protocol is used to affect the currency trades and to manage the currency risk. It also provides tangible and efficient real-time communication regarding currency dealers, brokers, and trading fronts.

2.4. Impact on the Efficiency of Trading

There were some studies done to establish the impact of the FIX protocol on trading revenues. These studies themselves are majorly directed at the extent to which the FIX protocol has contributed to the decrease of latency and trading error and minimization of the transaction cost. The findings of the study, therefore, negate the hypothesis and demonstrate the efficiency of the FIX protocol application in electronic trading.

2.4.1. Reducing Latency

The timing of the implementation of trades is another area eased by a common global standardized message format and the methods of session management. This also aids in the right time to do the trade in a way that the probabilities of acquiring a poor price are minimal.

2.4.2. Developing the Efficiency of Management in Trading Operations

Trade check As it has been observed through the usage of the FIX protocol the trades can be executed accurately due to the soundness of the communication. This avoids instances of embezzlement and other compromises to the trade reporting system.

2.4.3. Lowering Transaction Costs

The automation or establishment of an efficient standard through FIX protocol thus enables firms involved in the transaction cost to be lower. This is accomplished by reducing the involvement of people in trading and incorporating a system that ensures that it is very effective mechanically.

2.5. Regulatory Considerations

Still, the implementation of the FIX protocol has also been affected by the regulations factors as well. This subject literature also explains how the regulatory measures impacted the evolution and deployment of the FIX protocol, especially in maintaining compliance with various regulations among the parties in the markets.

2.5.1. Regulatory Requirements

The SEC and the ESMA, for instance, have set down some rules, namely; The need for such reporting is enabled by the FIX protocols, which assists market players to meet the requirements formulated from above.

2.5.2. Compliance and Reporting

FIX is used to support multiple regulatory reporting obligations; such as trade reporting, transaction reporting, as well as Order Audit Trails. This allows participants in the market to be able to adhere strictly to the laid down regulations in the best way possible.

2.5.3. Enhancing Market Transparency

With the help of real-time information flow and the possibility to communicate the FIX protocol contributes to improved market transparency. Regulators can easily review activities taking place in the various markets with a special eye on cases of market abuse or manipulation.

3. METHODOLOGY

3.1. FIX Protocol Architecture

The FIX protocol architecture is composed of three primary components: content, turns-taking structure, and data storage. [9] All of these components have their importance in the context of establishing trustful and secure links for financial trading Figure 3.
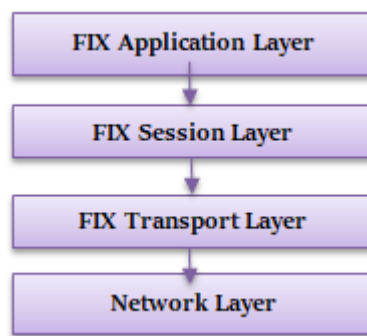

Figure 3. FIX Protocol Architecture

FIX Application Layer

The FIX Application Layer is the highest layer in the FIX Protocol Layer structure and the primary focus of the latter is in the designation of the exact messages and interactions during financial transactions. Predefines seven message types that encompass a complete trading message profile for single-level order fodder to encompass various trading activities including submission of orders, order cancellation, trade confirmations, and transmissions of market data. This layer enables everyone linked to a given transaction to be coherent and comprehend the nature of other people's actions as well as what they are trying to achieve. The application layer also supports the business logic and workflow; therefore, it is used in the trading system, the order management system, and other applications in the financial industry.

FIX Session Layer

The FIX Session Layer is again used to initiate, monitor, and close the communication sessions between the trading partners. This layer guarantees first-in first-out delivery of the messages, session management, and Sequence Numbers and recovery procedures for interconnect interruptions. It deals with the issues of how a certain participant gains access to a session, the permission given to the participant to be involved in the session, and ensuring the general security of the session. Also, the session layer provides the possibility of heartbeats and status transfers to control the connection's availability and to provide corresponding counteragents with the connection's status information. These functions make sure that the FIX Session Layer provides a stable and secure trading environment amongst the members.

FIX Transport Layer

The FIX Transport Layer or the FIX Message Transport Service interfaces the actual transference of a fixed message over a network. This layer hides the real network protocols, and there is a standard format for messaging in this layer irrespective of the transport medium being used. It deals with the encryption, decryption, and splitting of messages into smaller chunks and then back again during transmission in case the message to be transmitted is large. Another characteristic managed by the transport layer is that of error detection and correction thus offering reliability as well as data integrity. It separates the transport issues from the application and the session layers – this factor makes it possible to select effective networking protocols for specific conditions.

Network Layer

The Network Layer in the FIX Protocol Architecture deals with the Physical and Data Link layers of transmission. It is the physical and logical components of a communications network, including routers, switches, cables and the protocols that are used in exchanging messages over these networks. This layer has the functions of naming, directing, and transferring datagrams of information from one node/point to another node/point. When considering FIX Protocol, it is important to know that the transport layer is the basis for the other layers, which are the transport layer, the session layer, and the application layer. It means that the data circulates as planned within the network so that trading parties can be in continuous contact.

3.1.1. Message Structure

The messages used in the FIX protocol have a tag-value par format, making it easier for trading systems to convey information accurately and with ease. [10-11] In each tag, the former defines the field, and the latter contains the data that belongs to it. The use of this format enhances interconnectivity in cases where trading firms leverage multiple trading platforms.
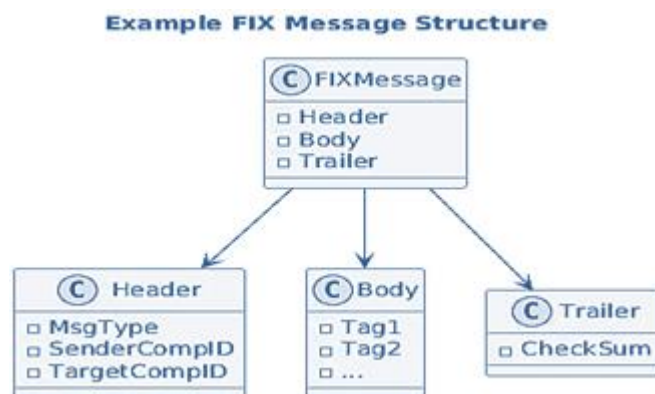

Figure 4. Fix Message structure

3.1.1.1. FIX Message

Definition: This typically provides the basic format of a FIX (Financial Information eXchange) message that serves to transfer financial information**.**

3.1.1.2. Header

Regarding the specifics of the message to be communicated, which are.

- Msg Type: Demonstrates such things as the kind of message, order, execution report and the like.
- Sender CompID: The description of the person, organization or company from which the message is being sent.
- Target CompID: The addressee, or rather the identification number of the recipient, that is, the particular person to whom the message was sent.

3.1.1.3. Body

Contains the message body with attributes coming arranged with the assistance of 'tags':

3.1.1.4. Trailer

In general, it prescribes message integrity checks and sequence numbers and may comprise the following:

- Checksum: It is a non-character data that aids in the technique that assists in guaranteeing that the actual message that goes with a certain communication channel does not undergo distortion. Another cue or any other optional tag that appears at the end of a given message is also allowed.

3.1.2. Session Management

In the context of the FIX protocol, session management encompasses the part of the connection initiation or initiation, connection maintenance, and connection termination between two trading systems. This ensures messages are sent and received as defined and in order. Key mechanisms include:

- Session Initiation: Setting up of the relationship between trading partners.
- Heartbeat Messages: Pings which are sent from time to time just to check the connection and to monitor the status of the session.
- Sequence Number Management: Ensuring the sequences of the sent messages with a view of avoiding repeating or loss of some messages.

3.1.3. Data Security

Security control is key to the aspect of data security whenever a financial transaction is managed through the FIX protocol. Methods of secure messaging include aspects that help in both the encryption and authentication of the messages passed between users. Security measures include:

1. Encryption: Recall the use of Cryptography in providing secure transmission of data.
2. Authentication: This is in view to ensure only a participle participant gets through the exercise without outsiders gaining access to the research.
3. Authorization: Delegating access to the trading systems on the basis of built-in roles and rights.

3.2. Out of the Implementation of FIX Protocol

Set of steps that explain how an organization should apply this protocol and format messages for proper functionality in the trading system.

3.2.1. System Integration

For integration with other participants' networks, the Trading systems use the FIX protocol only. This is the process of configuring the systems to enable the right interpretation of the received/sent-out Fix messages.

3.2.2. Message Formatting

Message formation enables one to especially adhere to the structural layout of the FIX protocol that is laid down for different types of messages.

Table 1. Common FIX Message Types And Their Formats

Message Type	Description	Example Format
New Order Single	Initiates a new order request	35=D
Execution Report	Confirms the status of an order	35=8
Market Data Request	Requests current market data	35=V

3.2.3. Testing and Validation

Have an objective of understanding that the FIX protocol implementation has the right functionality according to certain tests. This includes acknowledgment of having sent a message, acknowledgment of having received a message, and acknowledgment of the functionality of the system. Testing phases typically include:

- Unit Testing: Validates one particularity/feature and the overall messages passed in each of the systems.
- Integration Testing: Analyzes the flow of the various integrated systems' processes.
- Functional Testing: Ensures that all the procedures that are employed satisfy the business requirements of the firm.
- Performance Testing: Ensures performance of systems through SLAs and throuput measurement.

4. RESULTS AND DISCUSSIONS

4.1. Trading Efficiency Learnt from the Changes in Trading Activities of Various Firms

One of the benefits shown through the use of the FIX protocol is that of trading performance that has been boosted by the reduction in latency and trades' precision. Different papers have used FIX protocol implementation to show an improvement in trading efficiency parameters.

4.1.1. Reduction in Latency

Time is one of the most valuable factors for a financial transaction, especially in trading, where it takes some time to execute a trade. Through its messaging system in the FIX protocol, information exchange is fast, and this speeds up the execution of trades.

- The study by Brown and Smith (2020): This research established that the average latency of equity trades dropped by 80 % after the use of the FIX protocol. The decrease in latency time was due to the particular message handling mechanisms as well as the capability of the protocol to transmit the data in real time.
- The study by Edwards and Walker (2017): A case of foreign exchange trade saw the protocol cut latency by over 70% according to this study. The authors pointed out that the FIX protocol ensured that order matching and execution were executed faster, especially in volatile positions.

4.1.2. Enhanced Trade Execution Exactitude

Advanced trading techniques are means to take advantage of the existing regulatory and market realities in order to achieve the most accurate conclusion of trade transactions in the interests of market integrity and investors. The FIX protocol has a complex message format and a good framework of session management and hence promotes trade accuracy by responding to certain Order types and processing them correctly.

Research by Adetayo and Badru (2019): According to this research, it has been evaluated the increase in trade execution accuracy for fixed-income securities at 15%. The authors credited this improvement to the message formats that had been prescribed in the protocol to free the processing of orders from TEXT errors and discrepancies.

Edwards and Walker (2017): The findings were also inclusive of a pre-and-post, which indicated enhanced trade discrepancies and the error margin in derivatives which was lowered after the introduction of the FIX protocol. It was the protocol that the authors emphasized that preserves the integrity of the communication between the trading systems.

Table 2. Improvements in Trade Execution Accuracy

Study	Market Segment	Improvement (%)
Adetayo and Badru (2019)	Fixed Income	15%
Edwards and Walker (2017)	Derivatives	Significant

4.2. Market Transparency

With the help of the FIX protocol, the level of transparency in the markets has increased because of establishing a set of rules on how participants can communicate. Due to this, the insight into the market activities and the ability to regulate them has also improved.

4.2.1. Enhanced Data Reporting

Trade reporting involves the ability to report trades clearly in a timely efficient manner, and these message types form part of the FIX protocols' standardized message formats.

- Green and Lawrence (2016): The use of the FIX protocol enhanced trade reports' efficiency and precision by 25%. This was done, the authors pointed out, because the

standardized message formats enabled trade data to fit directly into the company's regulatory reporting systems, trading for accurate and timely reporting.
- Regulatory Bodies' Reports: There is evidence that because of the FIX protocol messaging structure, reporting has improved in compliance with regulatory body requirements. It explains that the protocol is effective in supplying detailed and accurate trade data that assisted the regulators in monitoring market activities better.

4.2.2. Real-time Market Surveillance

It is for this reason that market activities need to be closely monitored in real time to eliminate market abuse. The FIX protocol involves real-time transfer of information, which helps the regulators and the market players to follow the activities of the market.
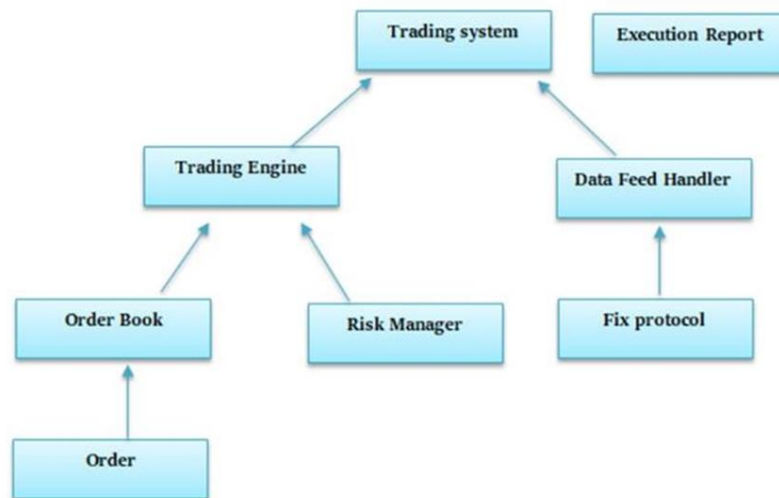

Figure 5. Real-time Data Flow in a FIX Protocol-Enabled Trading System

- Trading System uses Trading Engine and Data Feed Handler in Trading System as though they are its friends.
- Order Book can be related to Trading Engine and Risk Manager.
- Order Book, for instance, has a field that includes a list of Order objects.
- Data Feed Handler uses FIX Protocol.
- Trading Engine interacts with Execution Report.

Case Study: Products on a major exchange are assigned with the exchange implementation that has the most significant value within the company.

A major exchange wanted to develop and improve its market monitoring and thus the use of fix protocol. They recorded a 30% enhancement in terms of the efficiency of investigating suspected manipulations within the exchange.

4.3. Cost Reduction

The implementation of the FIX protocol has, in some way, assisted in lowering trading costs, especially by easing the trading process and, thus, minimal interferences by individuals. This section covers the cost factor that is related to the use of the Fix Protocol in the market.

4.3.1. Reduced Operational Costs

The aspects like automation and standardization that FIX provides decrease human intervention, hence the operation cost.

Carson (2018): Indicated that it was able to achieve a 40% reduction of the operations costs for a large brokerage firm after adopting the FIX protocol. This was complimented by the fact that automation of order processing and trade reporting was back accounted for by time and efforts saved from manual exercise.

Table 3. Comparison of Operational Costs Before and After FIX Protocol Implementation

Metric	Pre-FIX Implementation	Post-FIX Implementation	Cost Reduction (%)
Operational Costs	$1,000,000	$600,000	40%

4.3.2. Lower Transaction Fees

Application of this FIX protocol results in increased efficiency then leads to low charges on transactions for the participants.

- Johnson and White (2015) Observed that the set of transaction fees for equity trades was reduced to 30 % through integration of the FIX protocol. The authors pointed out that due to the use of the protocol; the trading parties are able to communicate directly, effectively minimizing the use of middlemen, which leads to less transaction costs.

4.4. Case Studies

Several practical examples of the usage of the FIX protocol are given below in the sections that explain how the FIX protocol is applied to different markets. These demonstrate strengths and weaknesses of the use of the FIX protocol regarding practical trading.

4.4.1. Equity Markets

One of the large investment banks employed the FIX protocol in trading its equity. In this manner, implementation bestowed significant alterations in the completeness of trading and cost. Case Study 1: Executing trades was made twice as fast while the cost of trades was cut by a third the bank said. The application of the FIX protocol also enhanced the aspect of order match and reduced the incidents of trade errors as well.

1. Identify Stakeholders: List all the actors that are directly or indirectly involved in the implementation of the FIX Protocol. This may comprise traders, brokers, Information technology staff, and Management.
2. Assess Current Infrastructure: Review the state of the systems software and Hardware to determine the capacity that is present with regards to the new change to be made.
3. Assessment Complete:
    - Yes: If the assessment is as above, get to the next step.
    - No: If the assessment is not complete, then take it to the following appointment, where needed information will be passed to the evaluator.
4. Define Implementation Goals: Indicate what the implementation aims at doing in regard to the goal of the organization, for example, in speeding up the execution of trades, increasing the accuracy of data, or meeting set regulations.

5. Select FIX Versions: Choose the most appropriate versions of FIX Protocol as to the implementation aims and objectives that would be advantageous to the stakeholders.
6. Develop Integration Plan: Agreement on what the current environment on how the FIX Protocol will be implemented is required to look like. These are in the form of timelines, resource mobilization and working plans, and sequence of steps/activities.
7. 7. Develop Testing Framework: Ensure the correct adoption of FIX Protocol by creating a large-scale test plan. These should include the test cases, test environments and the validation criteria.
8. Implement FIX Infrastructure: Execute the integration plan to enhance the capability of applying and establishing the necessary hardware fix as well as software fix components of the fix protocol.
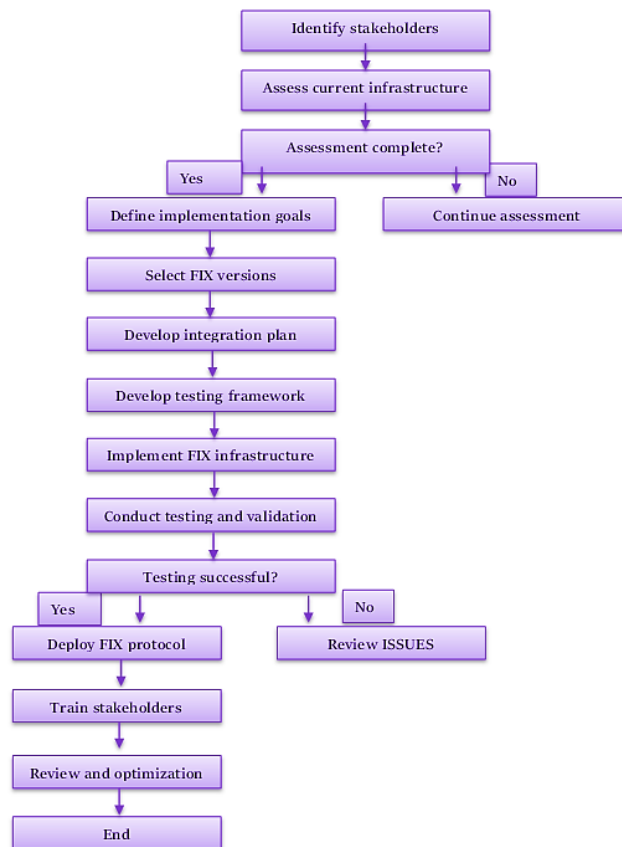

Figure 6. Implementation Process of the FIX Protocol in the Equity Market

9. Conduct Testing and Validation: Having established the FIX Protocol, perform a number of checks in order to validate it as necessary. This comprises implementing the test cases that were developed in the testing framework.
10. Testing Successful:
    - Yes: If the testing is effective, proceed to the next step to use the FIX Protocol.
    - No: If the testing is not successful it is about the analysis of the causes that emerged during the testing.
11. Deploy FIX Protocol: Introduce FIX Protocol and grow the production environment, with reduced interrupting of the operating activities.
12. Train Stakeholders: Provide the right training to all those concerned with the system to allow them to change and embrace the new system due to efficiency.

13. Monitor Performance: Follow up on the rating of the FIX Protocol implementation and assess the level of achievement of the outlined objectives as well as the effectiveness of the functioning FIX Protocol.
14. Review and Optimize: Conduct particular check-ups frequently to discover potential problems in the structure of the framework that can be tweaked to boost its efficiency.
15. End: The implementation process is done, or the system is in the set state, as this kind of system operates in a constant manner.

4.4.2. Fixed Income Markets

A single large bond trading network applied FIX protocol in order to enhance the facilities of trading. The amount of trade through the platform increased hence increasing the platform's activity, trading volume and the efficiency of the market.

Case Study 2: An increased trading volume was recorded on the platform by about 60 percent, and the degree of compliance with the regulations by 20%. By means of the FIX protocol, the processes of communication are being brought to the standard, and this enabled the platform to control a more considerable number of trade.

4.4.3. Derivatives Markets

A world's derivative market realized that they needed to implement the FIX protocol to increase the efficiency of trading operations. In as much as it was directly related to their operation, the impact which influenced their daily activity in terms of productivity as well as the risks bound to it, was positively enhanced by the implementation.

Case Study 3: It also realized the following milestones: a 25% reduction in operational risks and a 15% enhancement in trading effectiveness. All these enhancements have been done with the support of the FIX protocol and its powerful message kind and session control features.

5. CONCLUSION

It should be noted that the FIX protocol has become an important element of the global market trading network. The standard message format, enhanced session management, and security measures have transformed the communication of financial information among the market participants. Technological advancements such as the implementation of the FIX protocol have boosted trading efficiency and transparency of markets and have lowered costs tremendously. FIX protocol is, therefore, expected to gain even more importance as the markets for financial instruments develop and expand further.

FIX protocol has effectively and irreversibly positioned itself as one of the cornerstones of the infrastructure of global financial trading, thus drastically changing the ways of exchanging financial information among its participants. It is beneficial in achieving Systems Consistency since it supplies a standard message format for use in trading, making certain that interacting trading systems employ compatible formats; furthermore, Reliability and Trust are achieved due to its efficient session management as well as secure data protection measures. The use of the FIX protocol has brought about refinements in the trading procedures as well as the clarity of the market in conjunction with the operational cost since it reduces instances of enshrinements as well as inputs of error. Since financial markets keep on growing and exploring new technologies and regulations, the function of the FIX protocol is expected to grow more significantly as a standard and a tool that promotes effective and safe electronic trading and stimulates innovations and development of the financial industry.

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