AXISOFT

The Trade Life Cycle

George Ong

Contents

Overview

From the point a securities order is placed in a digital channel, there are several operations applied on the order and these operations depend on the asset you are trading.

The process of securities trading is complex because the transactions are normally completed by several agents from the buy-side or sell-side. And they will never meet each other.

When an investor wants to buy or sell securities, it will appoint a securities broker (e.g. banks) to handle the transaction. The broker will contact various parties to complete the transaction, such as marketplaces, dealers, custodians, etc.

This paper will walk through the operations after the securities are placed in the digital channels.

Four stages of trade life cycle

- Pre-Trade
- Trade
- Post-Trade
- Post-Settlement

Pre-Trade	Trade	Post-Trade	Post-Settlement

< Figure 1: 4 Stages of Trade Life Cycle >

CHAPTER 1

Pre-Trade

1. Pre-Trade

The pre-trade stage covers all the activities before the trade is accepted by the securities brokers from the investors or Relationship Managers (RM).

The pre-trade stage starts from the price discovery process which is a process to obtain the price of the asset class that the investors are going to trade.

Various agents provide price data, such as securities exchanges, dealers, or counterparty for Over-The-Counter (OTC) trades, or even third parties market data providers (e.g. Bloomberg).

Let's take equity as an example, each equity has two prices – the bid and ask price. The bid price is the price investors take to buy equity from the agent. The ask price is the price investors take to sell equity to the agent.

The price for equity quoted by the securities exchange or dealers is the actual price for the completion of transactions. However, the price for certain asset classes is indicative only, such as OTC structured products, unit trust, etc. The final price will be quoted after the completion of the transactions.

In addition to the price, other information is also obtained from the equity price data stream, such as the order queue of brokers and bid and ask price, transaction volume, etc.

After the securities prices are obtained, we can work out the trade economic and analyze the impact of the trade on the current portfolios of the investors. Such analysis requires real-time or historical market data or various analytic tools, for instance, tools for portfolio analysis or what-if analysis.

1.1. Robo-Advisory

Nowadays Robo-Advisory system (Robo Advisor) is also available in the pre-trade stage. The idea of Robo-Advisory is to apply sophisticated statistical models or machine learning algorithms with big data technology and other investment-related information to provide an investment suggestion or strategy to either the investors or RM.
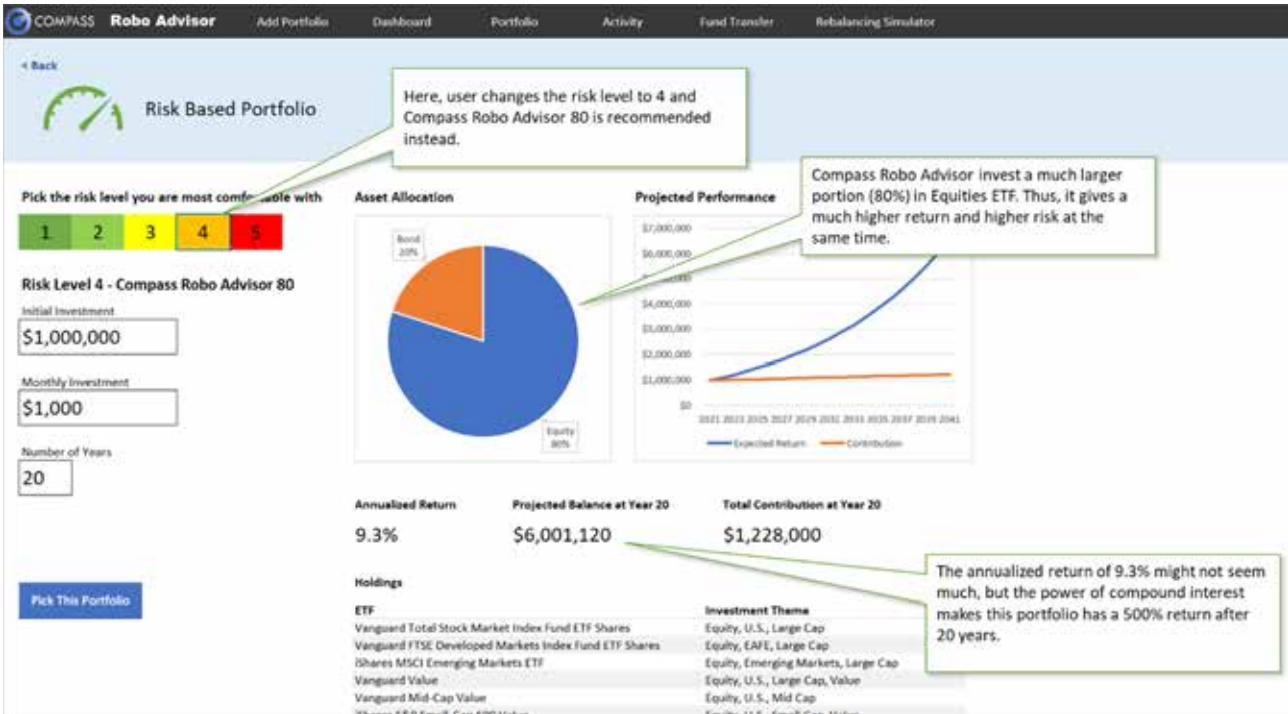
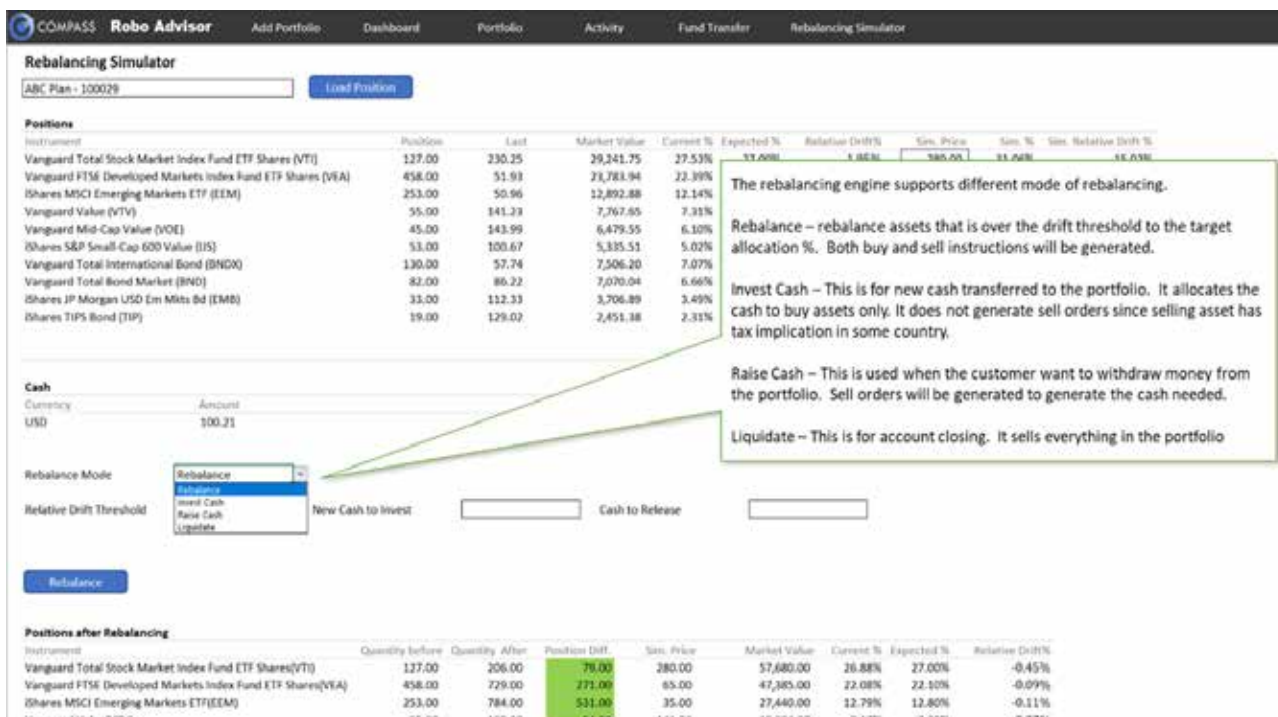< Figure 2: Asset Allocation Advised by Robo-Advisory >

Before the Robo Advisor conducts its analysis, investors have to define their investment strategy, goal, risk undertaken, and other investment preferences, such as products, duration, market, etc. Then they have to select and personalize a model portfolio. Then the Robo Advisor will calculate the asset allocation that meets all the investment requirements of the investors.

< Figure 3: Robo Advisory Strategies >

There are two main streams of investment strategies which are risk-based strategy and goal-based strategy. The risk-based strategy picks a model that is suitable for the customer based on the risk the customer is willing to take. The goal-based strategy picks a model based on the rate of return required to meet the goal defined by the investors.

< Figure 4: Rebalancing in Robo-Advisory >

After a certain period, the market price may change, and investors' investment requirements may also change. The Robo Advisor will re-calculation the asset allocation of investors' portfolios and generate the buy/sell order to attain the recommended portfolios. This process is referred to as Rebalancing.

One of the Robo-Advisory solutions is COMPASS Robo-Advisory Engine from Axisoft. The engine provides the modeling capability for various investment models so banks could launch new advisory services rapidly.

1.2. Pre-Trade Check

After the order details are completed and the order is submitted to the banks, there will be an operation of the pre-trade check (some applications refer to this as the middle office), which will cover a wide range of validations for order integrity, compliance, and risks, such as investment suitability, credit limit, and exposure, buying power, Anti-Money-Laundering (AML), etc.
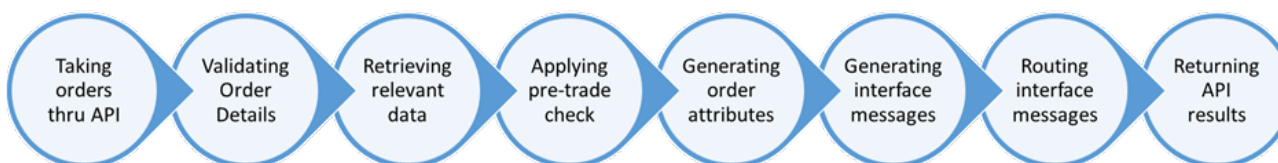
< Figure 5: The flow of Pre-Trade Check >

The checking process is divided into eight steps;

1.   Collect the trade details from the order capturing module

2.   Validate the trade details

3.   Retrieve relevant data from different data sources

4.   Conduct pre-trade check

5.   Generate order attributes

6.   Generate order interface message

7.   Route order to the securities brokers

8.   Route the execution result back to calling modules

The pre-trade check functions are normally provided by an independent and centralized engine for orders placed from different channels. Such system topology could minimize the cost and time for the pre-trade check maintenance and implementation.

One of the pre-trade check solutions is the COMPASS Investment Suitability Assessment and COMPASS Pre-Trade Engine from Axisoft. In addition to its functionalities, they come with key compliance rules from major regulators and markets.
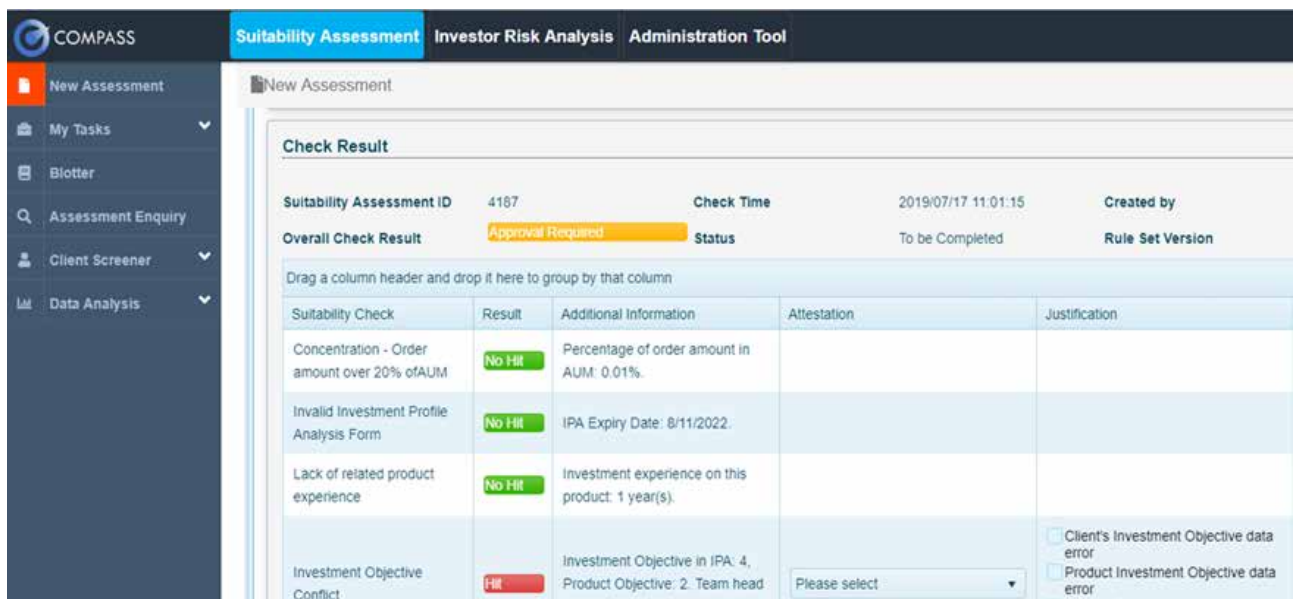
< Figure 6: Suitability Assessment >

After the order passed all the pre-trade checks, it is considered a valid order and is accepted by the securities brokers. Here is the end of the Pre-Trade stage.

CHAPTER 2
Trade

2. Trade

After the order is accepted by the securities brokers, it is the beginning of the Trade stage that covers all the operations to the point of the order being sent to various order execution agents for the completion of execution.

The common order execution agents are

- Securities Exchange (e.g. Hong Kong Stock Exchange or Singapore Exchange)
- Electronic Communication Network (ECN) from Securities Dealers
- Internal Securities Trading Department (e.g. Treasury Department)
- Securities Issuers or Brokers (for Over-The-Counter securities)
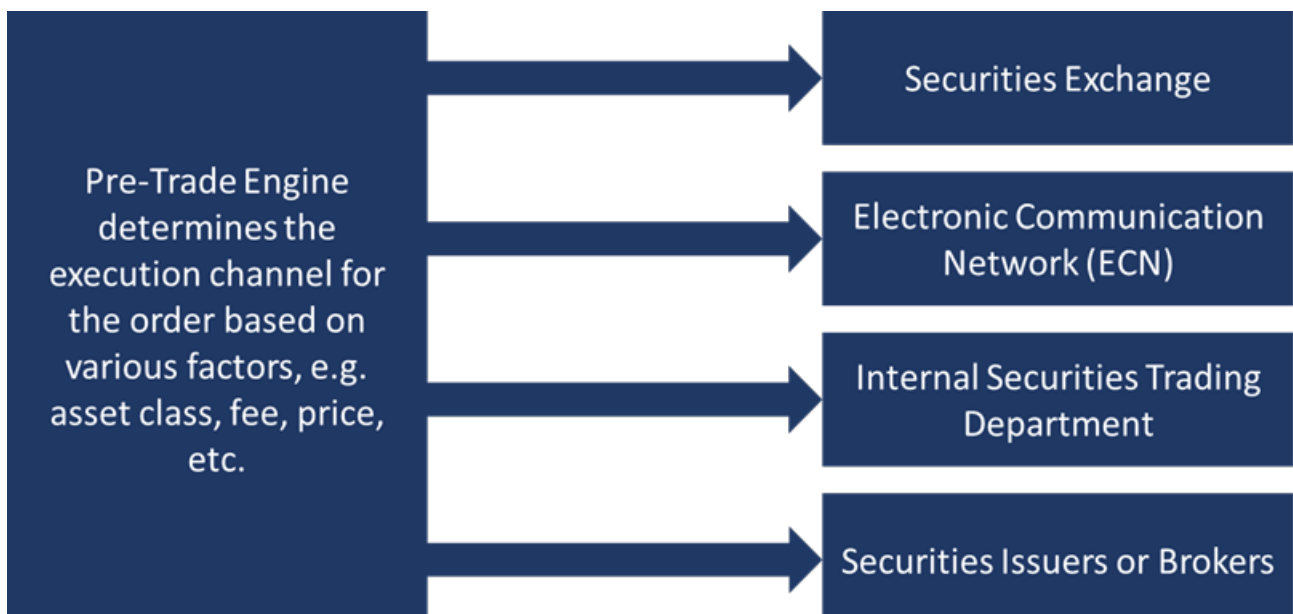
< Figure 7: Connectivity to various Execution Agents >

Connectivity to various execution agents is necessary because different execution agents may handle different types of securities.

Those exchange-traded products, such as equities, Exchange-Traded-Option (ETO), Exchange-Traded-Fund (ETF) will be executed by Securities Exchange or ECN. Fixed income products or OTC (Over-The-Counter) derivatives are executed by individual securities insurers or brokers.

In addition, having more connected execution agents increases the liquidity so that the best execution (best bid or ask price, lowest execution fee, and high speed of execution) could be obtained. Best execution is a compliance requirement by most of the regulators, such as the Monetary Authority of Singapore (MAS), Hong Kong Monetary Authority (HKMA), Securities and Futures Commission of Hong Kong (SFC), etc. Securities brokers are required to keep the evidence to show that the practice of best execution is applied in their dealing of client orders.

2.1. Trade Enrichment

Before the order is routed to the order execution agents, it requires an order enrichment process to complete its order attributes and generate execution messages according to the standard and protocol defined by the execution agents.

When the order is just accepted by the brokers, it contains minimal information from the channel, such as

- Client ID
- Order Date/Time
- Securities Code
- Buy or Sell Indicator
- Price
- Quantity
- Order Type (Market or Limit Order)
- Order Effective Date / Time (Open Order or Good Till Cancel)
- Etc.

However, additional data points are required by both the execution agents as well as the securities broker, such as

- Order Currency
- Booking Account
- Cash Account
- Execution Agent
- Commission
- Brokerage Fee
- Exchange Fee
- Tax and Duty
- Exchange Member ID of the Broker
- Stop-loss order
- Market If Touch (MIT)
- Fill or Kill (full or partial execution)
- Custodian Details
- Etc.

The order enrichment process is accomplished by an Order Attributes Generation Engine that comprises sets of business rules applied in different trading scenarios and connects to the core banking systems for static data retrieval. The engine generates these additional order attributes for the completion of order details. COMPASS Pre-Trade Engine from Axisoft provides comprehensive order enrichment functions that make the trade processing to be more efficient. One of the functions

is the Cost-Fee-Commission models that support flexible calculation models.


< Figure 8: Cost and Fee Model >

2.2. Trade Execution

With a complete set of data points of the order, we need to hold the necessary fund or securities from the corresponding account of the investors and generate execution messages of the order for the order execution agents. The standard and format of the message are defined by the order execution agents.

The common message standard is FIX (Financial Information eXchange). FIX is a network communication protocol used for the exchange of trade information between trading agents. For instance, the communication between online trading platforms and stock exchanges could base on FIX.
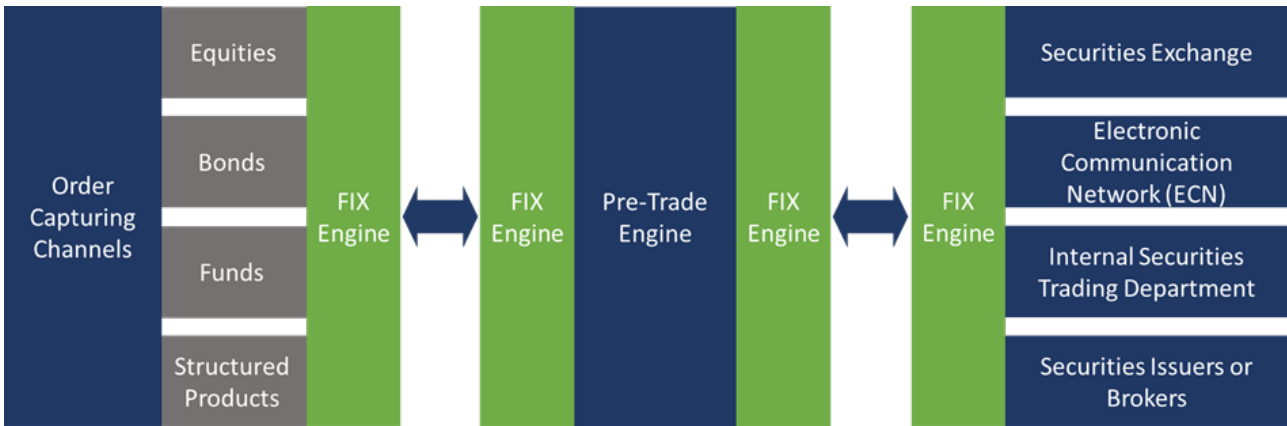
< Figure 9: FIX Connectivity >

The widely use of FIX makes it to an industry standard. FIX not just provides trading agents with not just cost and efficiency competitiveness, but also the flexibility to adopt new business requirements. Nevertheless, the FIX message is bulky and inefficient throughout the process. This is because of its wide range of features and capabilities.

< Figure 10: COMPASS FIX Screen >

COMPASS FIX Engine is one of the FIX message conversion solutions. It provides comprehensive FIX message conversion. It supports over the latest version of FIX, over 6,000 FIX data items, and all FIX messages.

The alternatives to FIX are the proprietary protocols provided by the trading agents, such as Nasdaq OUCH, Singapore Exchange OMEX, Hong Kong Stock Exchange OCG, etc. In general, these alternative protocols are more efficient than FIX because they are designed for communication with a single agent.

After the trade messages are generated, the brokers could connect to the trading gateway of the trading agents, e.g. stock exchange. Beforehand the brokers must be the members of the stock exchange, otherwise, they must route the trade messages through other prime brokers.

There are two types of order routing processes. The first type is batch mode, in which orders are consolidated as a single batch before they are routed to the trading gateway. The second type is the real-time mode, in which each order is routed to the trading gateway in real-time.

Which model is adopted depends on several factors, such as

• product type – some products, e.g. unit trust, only support batch mode
• order type – orders with execution date in future is in batch mode
• market data volatility – equity price changes rapidly or equity order is in real-time mode
• cost advantage – pooling orders in a single batch could give brokers some advantage on the transaction fee

For batch orders, brokers can download a file that contains the execution status of each order. Some execution gateways support a call-back mechanism that will call a program or API (Application Programming Interface) from the brokers and upload the order execution status file.

For real-time orders, brokers will get the real-time acknowledge and order ticket to confirm orders are received. Then the execution gateway will call the pre-defined API from brokers to send the order status in real-time until the orders are fully filled, expired, or canceled.

On the order hand, most of the execution gateways provide API order status query API, so broker trading devices or servers could query the order status based on the order ticket or other query criterion.

The completion of the trade stage could be split into several transactions in which every transaction fills part of the total quantity of the order. When the order quantity is fully filled, it is the completion of the trade stage. The purchased or sold asset is booked under to held from the investors' account.

The completion of the trade state of an order means the buy side and sell side agree to buy and sell a specific quantity of an asset at a specific price, and they have a legal obligation to complete the exchange of asset and cash on or before a specific date.

CHAPTER 3

Post-Trade

3. Post-Trade

The objective of the post-trade stage is to complete the exchange of the asset and cash for orders that have completed the trade stage.

The key activities in the Post-Trade stage are

- Matching
- Confirmation
- Settlement and Clearing

3.1. Matching

Since there are many parties, high trading volume, and many data items involved in the trading process, records in each party could be unavoidably mis-matched. The mismatch problem could be due to manual mistakes or system problems from one or more than one of the parties. It is important to catch the trade mismatch before the settlement to avoid settlement failure and save time and money in the settlement process.

For example, the order quantities, settlement instructions or OTC traded contract terms from the buy side and the sell side could be mis-match. This may be due to system bugs or miscommunication between the buy side and the sell side of the intermediate counterparty.

Depending on the asset class and degree of automation and standardization of the trading process, the mismatch rate and the matching approach are different. The higher degree of automation and standardization in the trade process, the low the mismatch rate and the simpler the matching process.

Equities traded at stocks exchange usually have Straight-Through-Process (STP). The trade records are highly standardized. The matching process is automatically done at the moment of the order completion in the trade stage. Hence it has an extremely low or even no mismatch rate, and the matching process is fully automated.

While derivatives traded through OTC usually have a trading process manually or only partially automated. In addition, each OTC traded contract could be different. Such a process is more error prone and has a higher mismatch rate. The matching process could also be very manual, such as by phone, fax, or email.

Other than the stocks exchanges, an automatic matching process could be carried out between the trade parties. In such a case, trade details will be sent to another party through electronic means, such as electronic files (for batch order matching process) or messages (for real-time order matching process). The format of the files or message could be proprietary or based on industry standards. One of the standards is the SWIFT (Society for Worldwide Interbank Financial Telecommunication) message, which is originally for payment transactions but has evolved to cover securities trading transactions. The way they respond to each other should be a proprietary protocol defined between

the parties.

Apart from carrying out the matching process by the trade parties themselves, agents are providing centralized trade record matching services.
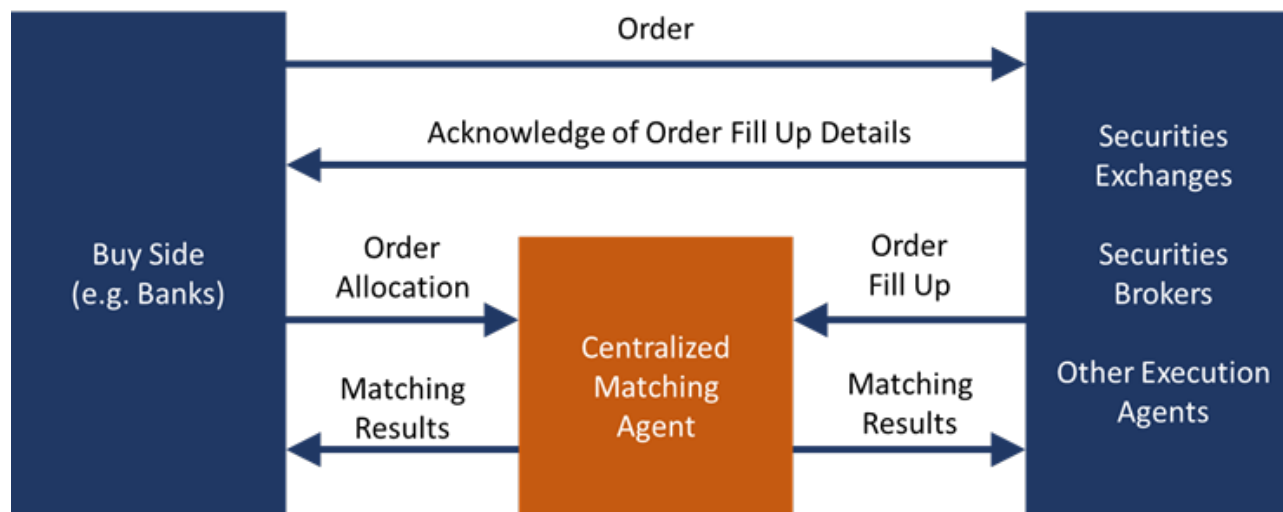
< Figure 11: Centralized Matching Process >

For instance, the Depository Trust & Clearing Cooperation (DTCC) provides a centralized trade matching platform for multi-asset classes. DTCC adopts a typical matching process in the industry.

In this process, a trade workflow is defined for each trading process. Then different parties in the workflow submit their trade records. The matching engine matches the records according to the workflow and determines if the records from all parties are matched. If the records are mismatched, the engine will identify which party has incorrect records. The engine will send the acknowledgment to each party to confirm if the trade records are matched or if there are any mismatched records.

The trade record matching process for institutional clients is far more complicated. This is because that involves data items that aggregate values from several trade orders. Hence complex logic is required in the matching process to handle this trade process complexity.

3.2. Confirmation

As the name stated, confirmation is the process to confirm the matching result. The process is simple for matched trades. However, it could be challenging for unmatched trades because you have to identify which record is correct and make amendments to another record. In other words, confirmation also involves the process of resolving the mismatch trades.

The simplest way to resolve mis-match trades is to clarify the trade details by phone calls, emails, or even face-to-face discussion. However, such a manual way may only be suitable for low volume trading environment, such as derivatives trading through OTC.

There is a need for an automatic, efficient, transparent, and fair protocol to resolve mis-match trades. One of the approaches is to use the typical matching mechanism mentioned in the last section. Throughout the workflow of the trade process, the original value of the mismatch data item could be determined. It will be taken as the correct value and applied to all the mismatched trade records.
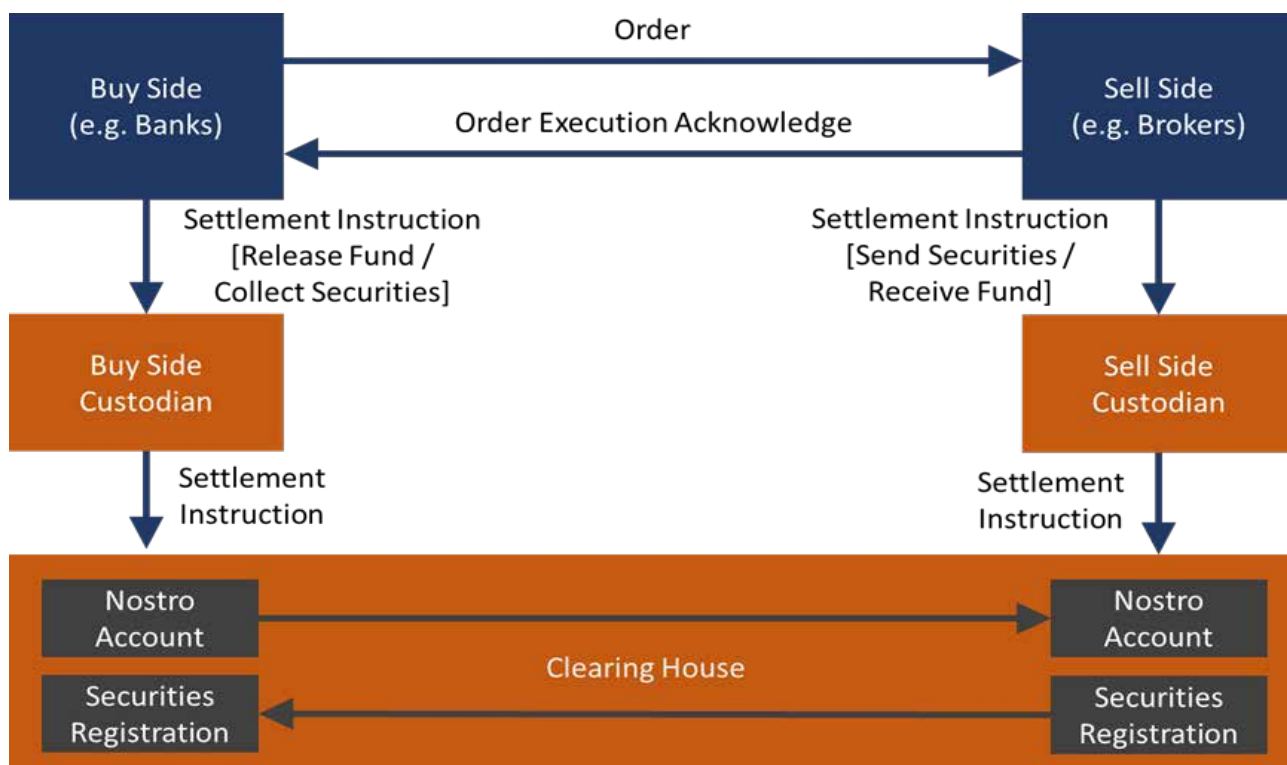
3.3. Settlement and Clearing

Settlement is the process of exchanging securities and cash. After the buy side and the sell side are legally bound to order and both parties confirm the order details are correct, they can exchange the securities and cash, i.e. the settlement process.

There are two types of settlement processes. The majority is DvP (Delivery versus Payment) which means the exchange of securities and cash is carried out simultaneously. This type minimizes the settlement risk. The minority is FoP (Free of Payment) which means delivering securities or cash before the receiving of cash or securities. FoP is usually used with the credit facility and is mainly for institutional clients.

The settlement process is not carried out by the buy side and the sell side, it is carried out by the custodian and clearing house. Custodian is one of the parties in the trade process. Its responsibility is to keep the securities for the clients, e.g. banks, brokers, dealers, or individual clients. Clearing houses are official organizations in the financial market. For instance, official clearing houses in Singapore are MAS and Central Depository Pte Ltd (CDP) are the official clearing house, the official clearing houses in Hong Kong are Hong Kong Securities Clearing Company Limited (HKSCC), HKFE Clearing Corporation Limited (HKCC), The SEHK Options Clearing House Limited (SEOCH) and OTC Clearing Hong Kong Limited (OTC Clear).

Custodian will take settlement instructions from the sell side to send securities to the clearing house and ask the clearing house to deposit cash into its client's Nostro accounts in the clearing house. On the other hand, it will take settlement instructions from the buy side to ask for the clearing house to release funds from its clients' Nostro accounts in the clearing house and collect securities from the clearing house.

Nostro accounts refer to cash accounts in different currencies and held by the clearing house in the name of the trading parties. When the trading parties engage with a clearing house, these Nostro accounts will be set up. They are used for cash deposits and release in the settlement and clearing process.

< Figure 12: Flow of Securities Settlement >

The settlement instructions are in the format of an electronic message. A widely used message format is SWIFT which is well accepted by most of the clearing houses. Among the messages from SWIFT, there are seven messages used in the settlement process.

SWIFT MESSAGE ID	MESSAGE DESCRIPTION
MT200	Transfer between two accounts of the same account holder
MT202	Payment of cash to a financial institution
MT210	Receipt of cash from a financial institution
MT540	Sent to a custodian to receive free of payment
MT541	Sent to a custodian to receive versus payment
MT542	Send to a custodian to deliver free of payment
MT543	Sent to a custodian to deliver versus payment

Depending on the asset class, the settlement process could be far more complicated than ordinary securities. For example, Equity Linked Note (one of the derivatives) involves the transfer of cash and a contract followed by multiple settlements that only involve cash transfer.

Because there are so many processes needed to be taken, that take time to complete. The financial market regulators have set a standard of the maximum number of business days from the completion

of the trade stage to the completion of settlement and clearing. In Singapore, Hong Kong, and the USA, the standard is 2 days and is referred to as settlement day and is expressed in "T+2" (Trade Date plus 2 business days). In China, the settlement day is T+0 which means the settlement has to be completed on the same day of the trade.

With the improvement of technology and STP, the market trend is to reduce the settlement day. This is because the longer the settlement day, the higher the risk of the settlement.

CHAPTER 4

Post-Settlement

4. Post-Settlement

On the completion of settlement and clearing, the buy side or the sell side should have the securities or cash received. But this is not the end of the trade life cycle, especially to the buy side as they are now holding the securities, their corresponding broker and custodian need to manage the ongoing economic, risk, and compliance of the securities. This is the Post-Settlement stage and the following are the key activities in this stage.

- Booking
- Credit Risk Management
- Corporate Actions Handling
- Day-End Process
- Reconciliation
- Reporting

4.1. Booking

Once the securities are received, the broker needs to book the securities under the securities account of the client according to the instruction from the client. Depending on the portfolio arrangement of the client, he may have more than one securities account for an identical asset class. For example, the client may have two securities account for Hong Kong stocks from HKEX, each of the accounts is under a different portfolio.

For a client who receives cash, the broker transfers the fund to the cash account of the client according to his instruction. In addition to multiple cash accounts, these accounts could be under different financial markets or jurisdictions. For example, after selling Hong Kong stocks, the client may instruct the broker to transfer his money to a cash account in Singapore.

Today's booking process is handled by a rule engine. Rules could be specified for the booking operation. Then rule engine will base on the transaction details, client instructions as well as the standard operating procedure of the bank to identify the booking account. COMPASS Booking Rule Engine from Axisoft is one of the solutions for this purpose.

4.2. Credit Risk Management

In the event of margin trading, there is a requirement of the pledge of collateral which could be in cash or other assets. The broker must evaluate the pledged collateral to make sure it is sufficient to cover the risk imposed by the market fluctuation. Depending on the market volatility, the evaluation could be on a regular or real-time basis. In case of the fact that the collateral is insufficient to cover the trade exposure (collateral shortfall), the broker has to ask the client to top up the collateral before a deadline, or he has to sell the securities to eliminate the risk.

Along the process, the most critical one is the calculation of credit exposure. Given the fluctuation of the market today, such calculation is required to be in real-time. In addition, the calculation is complex and required to be flexibly changed. COMPASS Credit Modelling Engine provides a means to solve the problem. Users can build and validate their credit models in Excel, the engine can execute the logic of the models.

4.3. Corporate Actions Handling

Corporate actions are business decisions, activities, or events that affect the value, status, and economics of the securities. These corporate actions are triggered by securities issuers who will then distribute the corresponding events to securities holders directly or through different agents.

There are many corporate action events, the common events for stocks are merges or splits, dividends, and rights issues. The common events for the bond are coupon payments, final redemptions, etc. These events are either mandatory (stocks split) or voluntary (rights issues).

Corporate action events can be captured manually and input into the investment systems by back-office operators. To improve the efficiency of the corporate actions processing, events can also be captured through STP, in which real-time messages or batch files of the events could be fed into the investment systems.

In most cases, the investment systems cannot take the corporate action events information directly and update the account of investors. For an instance, banks have nominal accounts in the stock exchange or other agents, the events information is regarding the holding of all the clients of the banks. Banks need to process the information to obtain the actual economic impact on each client.

In other cases, the actual economics are not stated in the corporate action information, and the banks need to calculate the actual economics of the securities for each client. For an instance, the beneficiary entitlement of bond coupon payment.

Once the economics of the corporate action events are obtained, the corresponding transactions will be created in the accounts of the investors.

4.4. Day-End Processes

After the closing of the trading day (window) and before the opening of the next trading day (window), many backend processes are running to calculate the snapshot of trading data, for example, the daily portfolio valuation, credit exposure, etc. Such processes are referred to as Day-End Processes. Such processes run after the trading day because they need trading data, such as the transactions and price, to be frozen.

The snapshot of the trading data will be sent to different systems for further processing, such as:

- The Portfolio Management System will take the portfolio valuation to calculate the portfolio

performance.

- The Risk Management System will take the credit exposure to determine if a collateral top-up alert is required.
- The Accounting System will split and book the transactions in General Ledger.
- The Reporting System will generate various reports for management and market regulators.
- The Investment Analysis System will produce trend and market analysis for clients and RM.
- The Statement System will generate bank statements for clients.

Given the complexity of the day-end process, the demand for the continuity of the business, and the high cost of the process failure, Robotic Process Automation (RPA) is getting into the picture of managing the day-end process.

RPA is a system agent (bot) with machine learning capability. It works like a data center operator that runs applications and makes intelligence responses based on the output of the application. You can train the bot by showing it how does an operator carries out the work and handle various exceptions. Once the bot learnt the operation, it can run it on its own.

For instance, the bot can open a user interface of report generation, input the report generate parameters, run the report according, wait for the completion of the report, then distribute the report according to report recipients. In addition, it could intelligence handle various situations based on the output shown on the screen.

4.5. Reconciliation

Due to the complexity of the trading process, trading data are being sent across the network to different systems and agents. That ends up with the possibility that trading data from different systems in a bank are different. Hence, trading data reconciliation is required between systems in the bank.

The most common reconciliation process is between the client statements system and source systems of the account balance and transactions.

Client statement is critical information sent by the bank to its clients. The accuracy of the information on the statement is regulated by the market regulators, such as MAS and HKMA. Banks are required to make sure the information on the statement is completely correct. However, incidents of incorrect client statements, such as statements containing information from other clients are happening from time to time. These incidents impose serious reputational and financial risks to the bank and need to be managed before the incorrect information reaches the clients of the bank.

To eliminate the incorrect information on the client statement, an end-to-end reconciliation process is required. End-to-end means extracting the data from the generated statements (not from the data in the client statement generation system). In general, these are PDF files. Then reconciling the data against various source systems.

< Figure 13: End-to-End Reconciliation of Bank Statement >

The challenge is the data extraction process as the information on the PDF file is unstructured, transforming this unstructured information to structured information is error prone. One of the solutions is the COMPASS Statement Reconciliation Engine from Axisoft. The solution provides flexible definitions to the client statement, so the data extraction process could be error proof instead of error prone.

< Figure 14: JSON file extracted from Client Statement >

In addition to the comparison of data from different sources, there are several additional considerations in the reconciliation process, such as;

- The sequent of reconciliation processes
- The frequency of reconciliation processes
- The tolerance level of data discrepancies
- The time window for the data reconciliation
- Data security and privacy consideration
- Reconciliation report and dashboard
- Data correction and error handling

4.6. Reporting and Business Intelligence

In addition to the static reports that are generated in a regular frequency, technology today extends the reporting function to real-time and dynamic analytic and data dashboards, which are usually referred to as business intelligence. It is a process that conducts the real-time analysis of the data from the data warehouse to obtain business insights. So that users can specify the criteria of the data requirements and the reports or analysis could be generated on the fly.

In the trading process, reports could be classified into 5 categories.

1. Management – For the assewssment of business performance and risk level
2. Regulators – For the fulfillment of business franchise and risk monitoring
3. Operation department – For the day-to-day business operation
4. Clients – For the client servicing, sales, and marketing
5. Trading agents – For operation risk and efficiency management

Regulatory reports are usually static and are generated regularly. The rest could be either static or dynamic using business intelligence.

The core enablement of report generation is a financial data warehouse. It serves as a master data source for reporting and operations of other downstream systems. It contains not just the latest data but also the historical data. These financial data are fed from different sources, such as trading systems, client information systems, back-office systems, etc. This process is referred to as ETL (Extract, Transform, Load), which is a fairly complex process in a large scale data transfer.
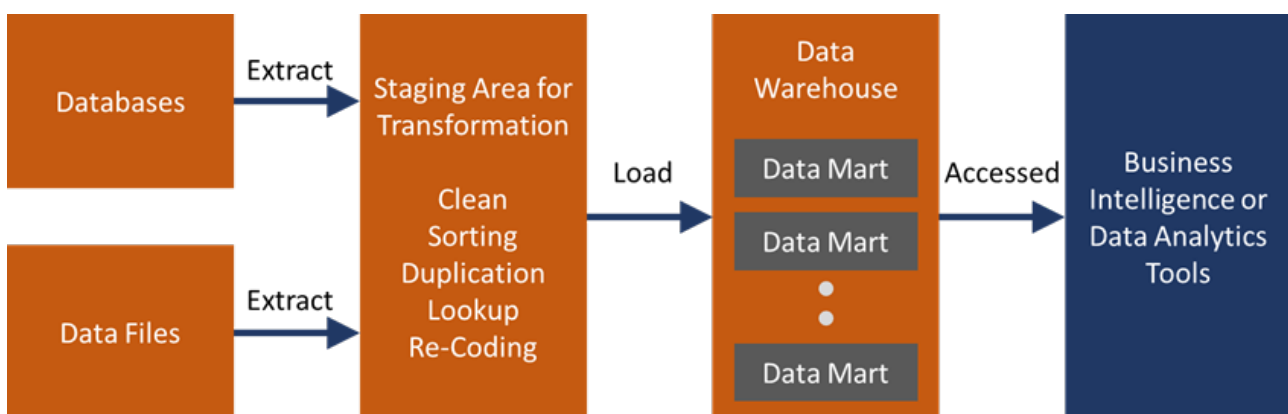
< Figure 15: ETL Process >

In the ETL process, data from different sources and in different formats are selected and saved (Extract) into a staging area, which could be a folder in a hard drive or a database. In general, the selection could base on the date and other criteria of the target data source. The staging area is a workspace for the preparation of the data before they are loaded into the data warehouse.

Data in the staging area will go through several processes (Transform), such as

- Cleaning – To validate the data and reject the data fail the validation
- Conversion – To convert the data to the acceptable format, for example, codebase conversion (EBCDIC to ASCII), precision conversion (integer to decimal).
- Classification – To classify the data into different categories. The process could involve the lookup of reference data or external data.
- Patching – To fill the value of missing data, such as the default value of the numeric data items or the data process date.

After the completion of the transformation processes, the data are rearranged and loaded to the target tables in the Data Warehouse (Load).

One of the challenges today is the ETL frequency that determines the updated level of the data. Today business is demanding near-time or even real-time information in the reports. However, achieving such requirements requires sophisticated data and technical analysis and design.

Summary

The trade life cycle of securities trading is a complex process. This paper gives an overview of the process from both business and technology perspectives and illustrates the details and key considerations in each of the stages of the trade life cycle.

About the Author

George Ong is the CEO of Axisoft and AlchemyJ. He has been working in financial technology for over 25 years and helped financial institutions in Singapore, Hong Kong and Switzerland build their wealth management systems.

His expertise lies in applying state-of-the-art technology to streamline the core business operations of financial institutions. George holds an MSc in Engineering from the Chinese University of Hong Kong.

GEORGE ONG

CEO

Axisoft and AlchemyJ

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