

T7 Release 5.0

T7 Functional and Interface Overview

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1 Introduction

T7 is a state-of-the-art trading architecture developed by Deutsche Börse Group. T7 offers high performance together with reliable connectivity, enriched trading functionality, as well as a faster time-to-market. The T7 trading architecture is used to operate the derivatives markets as well as the cash markets of Deutsche Börse group. The ISE will be migrating to the T7 platform with the launch of ISE T7 on **17th July 2017**.

This document provides an overview of the T7 trading architecture's functionality with all its interfaces. Please refer to the "Functional Reference" for extensive information.

1.1 Purpose of this document

This document describes the main capabilities of T7's trading architecture used for both the cash and derivatives markets, with a focus on the functionality specifically relevant for ISE T7. The following reflects the main functionalities:

- Concept of multiple markets, products and instruments (incl. states)
- Concept of participant, business unit and user set-up
- Overview of on-book functionality
- Overview of interfaces for trading and market data, respectively reference data

1.2 Further reading

The following documents provide additional information:

Overview and Functionality	Interfaces
<ul style="list-style-type: none">• T7 Release 5.0 (Release Notes for ISE T7)• T7 Functional Reference• Participant and User Maintenance Manual• Market Model ISE T7	<ul style="list-style-type: none">• Trader and Admin and Clearer GUI - Manual• T7 Market and Reference Data Interfaces – Manual• T7 Enhanced Order Book Interfaces – Manual• T7 Extended Market Data Services – Trade Prices, Settlement Prices and Open Interest Data Manual• T7 Extended Market Data Services – Underlying Ticker Data Manual• T7 Market and Reference Data Interfaces
Reports	
<ul style="list-style-type: none">• Common Report Engine (CRE), User Guide	

Table 1: Further Reading T7 Release 5.0

All the documents are available on the website of the ISE:

ISE's website: www.ise.ie, in the 'Trading System' section on the following page:

[Equity-Trading-Membership](#)

1.3 Definitions and Abbreviations

The following are the definitions and abbreviations used in the Functional and Interface Overview:

Abbreviation	Definition
CCP	Central Counterpart
EMDI	Enhanced Market Data Interface
EOBI	Enhanced Order Book Interface
ETF	Exchange Traded Fund
ETI	Enhanced Trading Interface
FIX	Financial Information eXchange (Protocol)
ISE	Irish Stock Exchange plc
ISE T7	The future electronic trading system of the ISE, to be introduced on 17 th July 2017
On-book	Refers to order book trading
MDI	Market Data Interface
RDF	Reference Data File
RDI	Reference Data Interface
T7	Cash & Derivatives trading system developed by Deutsche Börse Group
EMDS	Extended Market Data Service
Xetra (system)	Existing Xetra trading system of Deutsche Börse
Xetra (trading venue)	Trading venue with Market Identifier Code "XETR" (Deutsche Börse)

Table 2: Definitions and Abbreviations

2 Main Components

The following chapter describes the main components of the T7 trading architecture.

2.1 Markets, Products and Instruments

The T7 trading architecture provides the capability to operate multiple markets (i.e. Eurex, Xetra (Frankfurt cash market), Dublin) on one technical instance. The following figure shows the T7 market hierarchy with its markets, product assignment groups, products and instruments:

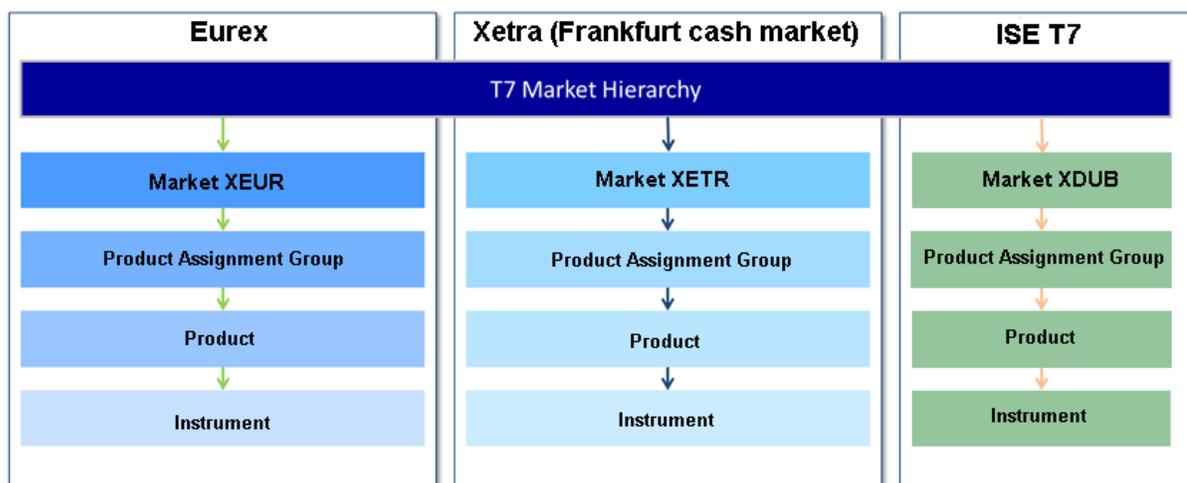


Figure 1: T7 Market Hierarchy

Instruments in ISE T7 are the tradeable entities, i.e. an order refers to buying or selling a specified quantity of a certain instrument. Instruments of the same type may be grouped to form products, and every instrument must belong to a product. The product itself is associated to a product assignment group. For ISE T7 Release 5.0 there is a 1:1 relationship between instruments and products.

The product assignment group is used for Entitlement. Please refer to section 2.4.2 for more details. Each product assignment group refers to a specific market.

All ISE equities and ETFs are classed as “simple instruments” using the T7 instrument type classification.

2.2 Instrument Types

This section introduces instrument types in T7. In general, it is distinguished between three instrument types referred to as “Simple Instrument”, “Complex Instrument” and “Flexible Instrument”.

The following figure represents an overview for the cash and derivatives markets. **The ISE T7 market contains only simple instruments (i.e. equities and ETFs):**

	Derivatives Market	Cash Market
Simple Instruments	Futures Contracts, Option Series	Equities, Exchange Traded Funds, Exchange Traded Commodities, Exchange Traded Notes, Money Market Funds
Complex Instruments	Futures Spreads Standard Futures Strategies Packs and Bundles Strips Inter-Product Spreads Standard Options Strategies Non-Standard Options Strategies Option Volatility Strategies	-
Flexible Instruments	Flexible Futures, Flexible Options	-

Figure 2: Instrument Types on T7

2.3 Trading States

This section provides an overview of the trading states supported by T7. Overall, T7 supports two trading states, i.e. the “**product state**” and the “**instrument state**” which are explained in the following sections.

2.3.1 Product States

With the help of the product state, the business day is structured in a timely manner and the overall access to the trading system is controlled on product level. The following table represents typical product states for a common trading day:

Product State	Description
Start of Day	<ul style="list-style-type: none"> ➤ Represents the time in the morning before activity begins. ➤ Participants have no functional access to the trading system.
Pre-Trading	<ul style="list-style-type: none"> ➤ Represents the phase before trading starts providing traders the possibility to prepare themselves for trading in terms of order maintenance (without execution).
Trading	<ul style="list-style-type: none"> ➤ Represents the trading phase during the day where order execution is possible and market data is available.
Closing	<ul style="list-style-type: none"> ➤ Phase between Trading and Post-Trading phase which covers the time between the end of continuous trading and the end of the closing auction.
Post-Trading	<ul style="list-style-type: none"> ➤ State in the evening after trading has ended. It is typically a time where traders can maintain their orders in preparation for the next trading day (no execution).
End of Day	<ul style="list-style-type: none"> ➤ Phase in the evening reserved for the end-of-day processing by the exchange. ➤ Participants have no access to the trading system any more.

Table 3: Overview of Product States

Additionally, T7 supports two other product states for specific situations:

Product State	Description
HALT	<ul style="list-style-type: none"> ➤ The exchange may halt a product if it deems that market conditions or technical conditions require this. In this product state, no trading occurs and access to the order book is restricted.
HOLIDAY	<ul style="list-style-type: none"> ➤ This product state applies to products that are not open for trading on that day, even though the exchange is open. Participants have no access to the trading system for a product that is in the product state Holiday.

Table 4: Special Product States

2.3.2 Instrument States

The instrument state refers to the individual state of the instrument and controls the trade activity in the order book as well as the market data distribution. The following figure shows the typical sequence of instrument states in the normal continuous trading model.

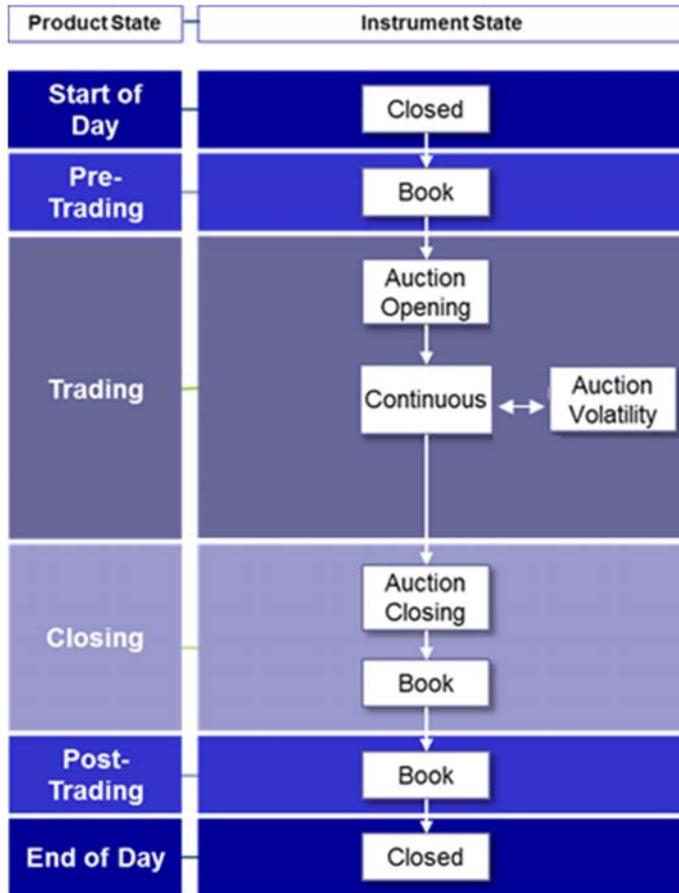


Figure 3: Typical Product and Instrument States

The table below describes the instrument states referred above:

Instrument State	Description
Closed	No access to the order book, no executions and no data distribution.
Book	Order/ quote maintenance is possible but no executions and no data distribution.
Continuous	Order/ quote maintenance as well as continuous matching of orders and quotes are possible. Trade data is published by the exchange.
Opening/ Closing Auction	Order/ quote maintenance are possible but no executions. Only certain information is published (either best bid/ask or the potential auction price, and the accumulated volumes (see the Market Model)). It is possible that within an opening/ intraday or a closing auction, a volatility auction is triggered if the auction price is outside a predefined price range.

Table 5: Time Triggered Instrument States

Further instrument states may occur throughout the trading day, which are event triggered:

Instrument State	Description
Volatility Auction	Order/ quote maintenance are possible but no executions. Only certain information is published (either best bid/ask or the potential auction price, and the accumulated volumes (see the Market Model)). Volatility auctions occur if the potential execution price is outside a predefined price range.
Restricted	Only deletions are possible (no order/quote maintenance, no executions, no data distribution).
Freeze	No order/ quote maintenance and no executions are possible. Deletions are marked as 'pending'. Top of the order book is published (either best bid/ask or the potential auction price, and the accumulated volumes (see the Market Model)). After freeze, potentially resulting trade is published. This state usually occurs at the end of an extended volatility interruption.

Table 6: Event triggered Instrument States

2.3.3 Fast Market

A Fast Market is declared by the ISE when an especially volatile market situation is expected. During this time, certain price controls are relaxed, e.g. minimum quote spread requirements.

In T7, Fast Market is a special status of the product that the ISE can set independently of the product and instrument states. This allows for example, a product to be set to Fast Market early in the morning before trading starts, without any impact on the sequence and timing of the product states.

2.3.4 Order Book Instrument Status

In T7, the instrument status is different from the instrument state. The instrument status controls in principle if the instrument is available for trading or not.

The following instrument status are available in T7:

Instrument Status	Description
Active	The instrument status of an instrument to allow trading.
Inactive	The ISE may decide to deactivate an instrument during the day. Trading is deactivated completely.
Suspended	The ISE may suspend an instrument under unusual circumstances. A suspended instrument will acquire the listing status 'Suspended' as opposed to Active. Trading is not possible any more, and the instrument state is changed to 'Restricted'.

Table 7: Instrument Status

2.4 Participant, User Concept & Entitlement

The member structure in T7 consists of three hierarchical levels: The **Participant** on the first level, the **Business Unit** on the second level and the **User** as well as the **Session** on the third level.

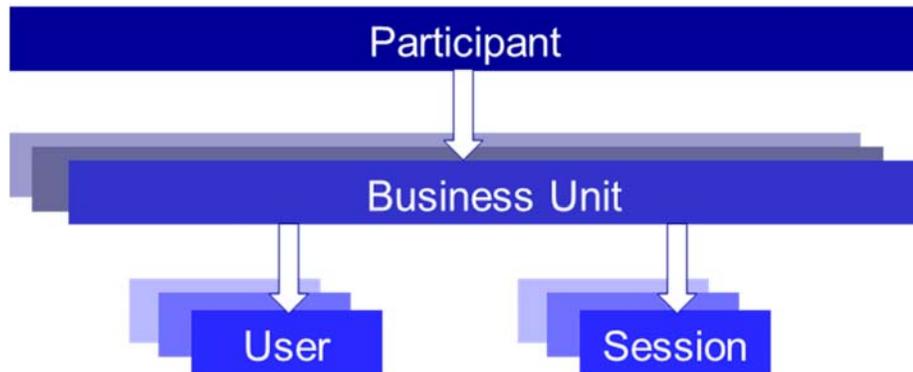


Figure 4: Participant hierarchy in T7

The following provides definitions on the member structure:

- **Participant:** The Participant is the highest level entity in the member structure of T7. It is the member firm (trading or clearing member), or a service provider.
- **Business Unit:** A Participant may have several business units working independently. There is distinguished between two types of business units:
 - **A Trading Business Unit** - used by Members for trading only.
 - **A Clearing Business Unit** - used by clearing members to receive trade confirmations from its own trading business units and from the trading business units of their related non-clearing members. A clearing member business unit supports the user concept as for the trading business units. Users can view the above mentioned trades in the T7 Clearer GUI.

Each trading member initially has just one trading business unit and each clearing member has just one clearing business unit. Participants providing both trading and clearing will get both a trading and a clearing business unit.

- **User(s):** A business unit can have multiple users. A user can be a trading user and/or an administrator.
- **Session(s):** Sessions are permanently registered connection channels to T7. A session is set up for and belongs to exactly one business unit. In order to send requests to the trading system, a user must use a session that is connected to T7 and that belongs to the same business unit as the user. Besides that, there is no further relationship between users and sessions, i.e. a user does not belong to a specific session and a session does not belong to a specific user. As long as the session belongs to the same business unit, users can use different sessions simultaneously.

2.4.1 User Concept

There are three user levels: ‘Trader’, ‘Head Trader’ and ‘Supervisor’.

- A “Trader” can enter/ modify/ delete his orders only.
- A “Head Trader” can enter/ modify/ delete own orders and in addition he is allowed to modify and delete orders of the traders in the same trader group. Entry on behalf is not possible.
- A “Supervisor” can enter/ modify/ delete own orders and in addition he is permitted to modify and delete the orders of the traders in the same business unit. Entry on behalf is not possible.

With T7, users are configured by the member for trading via the Admin GUI and for Clearing via the Clearing GUI. Trading users must be approved Registered Traders of the ISE as per the existing requirements.

2.4.2 Entitlement

The entitlement in T7 consists of a concept of roles, in combination with product assignment groups or a market. The roles enable the participant to manage user resources more easily. For example, a trader role is enriched by all resources enabling the user to trade (e.g. enter order request, modify order request, etc.). Another example is the role of the “Service Administrator” enabling the user maintenance.

The roles are assigned to the (trading/ clearing) business units by the ISE. From here, the member can inherit the entitlement to its users. It is possible that a user has more than one role, some effective market-wide and some per product assignment group. The following figure represents an overview of the entitlement:

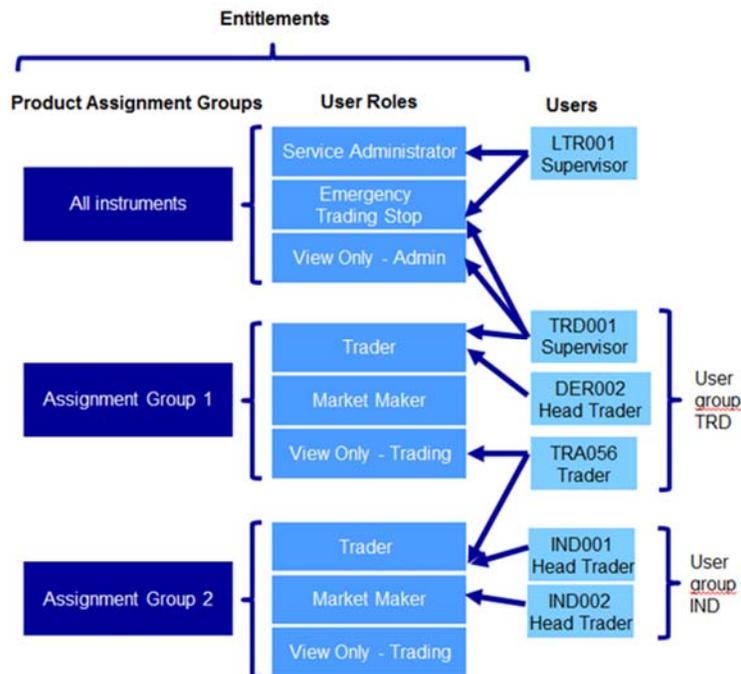


Figure 5: User Entitlement Overview

Thus, it is possible that a user having the “Trading View” role (i.e. he is only allowed to see trading information) in one product assignment group can act as Market Maker in another product assignment group.

The following overview provides an insight to all available roles in T7¹:

Roles	Relevant for ²				Description
	TBU	CBU	MKT	PAG	
(Cash) Service Administrator	X	X	X		Set up new users, maintain their entitlement as well as delete users.
(Cash) User Data View	X	X	X		Allows viewing user data information of himself/herself and other users.
(Cash) Trader	X			X	Enables trading, e.g. enter orders.
(Cash) Trading View	X			X	Allows viewing the trades, e.g. to inquire them.
(Cash) Market Maker	X			X	Enables Market Maker activities, e.g. enter quotes.
(Cash) Emergency Mass Deletion	X		X		Allows deleting all open orders and quotes.
(Cash) Emergency Trading Stop	X		X		Allows stopping the entire trading member in case of emergency. All open orders/ quotes are deleted.
CM Backoffice View		X	X		Allows inquiring of trades of the related trading participants.
Trade Enrichment Rule	X		X		Enables to view and maintain trade enrichment rules. This feature is used for automatic enrichment of executed orders and quotes that use the short order message layout.
Trade Enrichment Rule View	X		X		Enables to view all trade enrichment rules without update capability.

Table 8: Overview of Roles Functionality

¹ For further details, please refer to the “Participant and User Maintenance Manual”.

² TBU = Trading Business Unit, CBU = Clearing Business Unit, MKT = Market, PAG = Product Assignment Group.

3 Order Book Functionality

This section describes the order book functionality for the ISE T7 market.

3.1 Orders

ISE T7 supports multiple types of orders to fulfill member needs and expectations. All orders entered are anonymous, i.e. the business units do not receive any information on who entered an order.

Depending on the market and the traded instrument, the allowed combinations of order types, restrictions, price conditions and validities may differ.

Nevertheless, there are two attributes which are mandatory and valid for all orders: the order persistency and if it is standard or a lean order. The following figure depicts the differences as well as the combination possibilities.

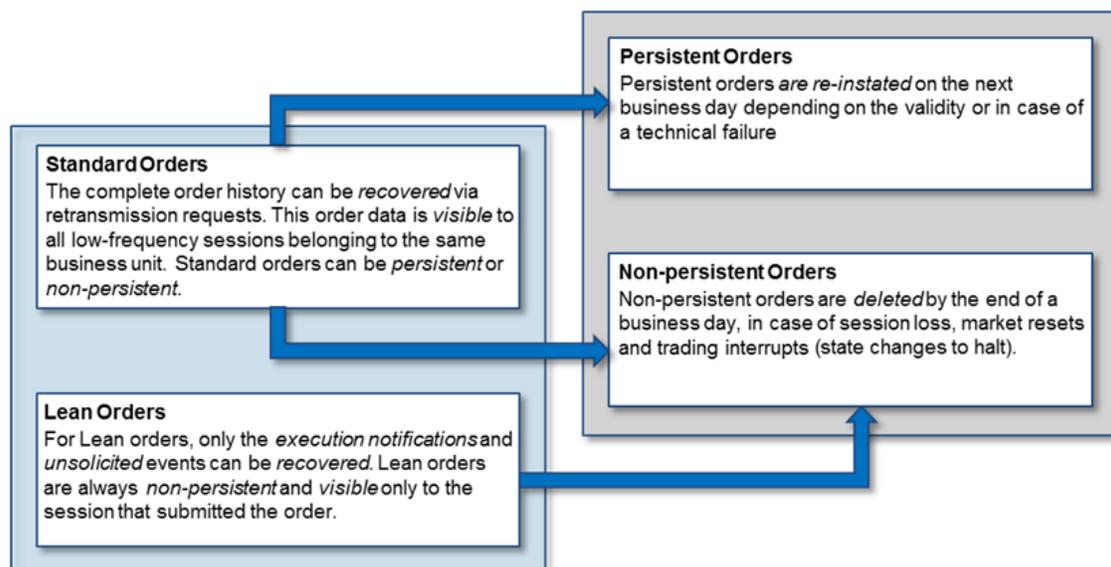


Figure 6: Standard/ Lean Orders vs. Persistent/ Non-persistent Orders

ISE T7 supports the following order types, price conditions, restrictions and validities:

Order Type	Description
Limit Order	A limit order is an order that does not get executed at a price worse than its limit.
Market Order	A market order is an order without price.
Stop Order (Stop Limit only for the cash markets)	In case the market reaches the stop price, the stop order is triggered and routed to the order book. The stop order is available as a stop market or a stop limit order.
Iceberg Order	Iceberg Orders are orders with quantities only partially visible, i.e. only visible with its peak in the order book. The refill of the peak after execution can be configured to be random.

Table 9: Order Types

Order Restriction	Description
Auction Only	If this restriction is set, the order can only get executed during a scheduled auction phase but not during continuous trading or an (extended) volatility interruption.
Opening Auction	If this restriction is set, the order can only get executed during the opening auction.
Closing Auction	If this restriction is set, the order can only get executed during the closing auction.
Book-Or-Cancel	Orders using the restriction Book-or-Cancel (BOC) are accepted and written only to the order book if its execution is not possible (fully/ partially) on entry.

Table 30: Order Restrictions

Order Validity	Description
Good-for-Day	Orders entered "Good-for-Day" (GFD) will be deleted at the end of the trading day they were entered on.
Good-till-Date	Orders entered "Good-till-Date" are valid until the date specified by the user. The order is then deleted automatically during the end of day processing of its last validity day.
Good-till-Cancelled	Orders entered "Good-till-Cancelled" (GTC) remain in the system until the deletion by the user itself.
Immediate-or-Cancel	For orders entered as "Immediate-or-Cancel" (IOC), the quantity that cannot be executed immediately upon entry, is deleted.
Fill-or-Kill	For "Fill-or-Kill" (FOK) orders either the total quantity is matched upon order entry or nothing is executed at all and the whole order is cancelled.

Table 11: Order Validity

Order Identification

An order can be tracked via the Order ID assigned to every order on entry. The Order ID is unique per product and does not change over the whole lifecycle of the order. This means that T7 may assign the same Order ID to orders belonging to different products. Please note in that context that the same security set up in different markets will be assigned to separate products.

In addition to the Order ID, every order is assigned a System Order ID Version Number (starting with 0) which increases in case of a user driven order modification with a priority change, i.e. in case of

- Changing of limit price
- Increasing the quantity
- Extending the validity

For more information on order tracing, please refer to section 5.

Order deletions

Orders can be either be persistent or non-persistent. Depending on the scenario, order deletions are triggered automatically. The following provides an overview:

Event	Delete Non-Persistent Orders (N), Delete Persistent Orders (P)	Pending Delete possible (Y / N)
Volatility Interruption	-	N
Instrument Suspension	N, P	N
Instrument Stop	N	N
Product temporarily not tradeable (Slow Partition)	N	N
Product State Halt	N	N
Product State Holiday	N	N
Mass Delete by Market Operation	N, P	Y
Session Disconnect (Loss, Logout or Duplicate Login)	N	Y
Mass Cancellation by Trader	N, P	Y
Emergency Mass Delete by Trader	N, P	Y
Trader/Business Unit Stop	N, P	Y

Table 12: Order deletion scenarios

Please note, that the order deletion scenarios include quotes which are non-persistent as well.

3.2 Quotes

ISE T7 enables the entry of double-sided quotes, with the following conditions:

- Quotes belong to the session on which they are entered, refer to section 4.1.1. A business unit can have multiple sessions, each with its own quotes.
- The “mass quote” function allows the users to enter, overwrite and delete multiple quotes of a session simultaneously.
- T7 provides “quote entry” to replace an existing quote with the new quote. This is done by starting a new quote life cycle with an accumulated traded quantity set to zero. It also provides “quote modification”, which refers to an existing quote and preserves the accumulated traded quantity. The priority timestamp of a quote stored in the order book is changed when the price is changed or the open quote quantity is increased.
- The “delete all quotes” function can be used to delete all quotes of a session in a product.
- An incoming or a modified quote which fails the price reasonability check or the extended price range validation results in:
 - Rejection of the incoming or modified quote
 - Deletion of the old quote (i.e. with both sides) in the book belonging to that session and instrument.
- Quotes are always non-persistent and automatically deleted in specific situations. Please refer

to the table “Order deletion scenarios” in section 3.1. All quotes of a session can be inactivated and re-activated. This feature can be applied within the product scope or the product and instrument type scope. When quotes of a session are inactivated, they are unavailable for matching, but can be updated while remaining inactive. During the time of the inactivation, any new quote entered into the session will also be inactivated. When quotes are (re-)activated they receive a new matching time priority.

3.3 Market Models & Matching

T7 has the capability to support different trading models or trading forms. The model for ISE T7 is the “Continuous Trading (with Auctions)” model.

In principle trading is arranged in a way that the best priced orders in the book are traded first when an order is entered into the order book. If there are multiple orders at the best price, the allocation scheme specifies how the quantity of the incoming order is allocated to those book orders. T7 supports the following allocation schemes: Time allocation, Pro-rata allocation, Time-pro-rata allocation.

3.3.1 Allocation schemes

The allocation schemes applied to the derivatives markets can be different per product and instrument type. For the ISE T7, the “Time allocation” scheme is used.

This means that the quantity of the incoming order is allocated to the oldest book order first. If there is any remainder then it is moved to the next oldest order, until the quantity of the incoming order is exhausted or all orders at the best price have been executed.

3.3.2 Safeguards for Participants

Participant safeguard functions in ISE T7 include:

- Maximum Order Value determining the maximum value of an order that a trader is allowed to enter.
- Manual stop of trading which can be applied to the whole member, on a business unit, or on an individual trader. Manual stop may be performed by a trading member or by the CCP.
- Price validations for orders and quotes safeguarding that the limits entered are not done in error or that the orders and quotes are executed at a price far away from the market without a notification to the traders or the market.
- Volatility Interruptions which interrupt trading by a volatility auction state to enable the members to adjust their orders due to the current market condition. Volatility interruptions are supported at both the instrument and the product level.
- Self-Match Prevention (SMP) functionality which allows a business unit to prevent that own orders of the same instrument match against each other. SMP is supported during continuous trading, but not in any matches in an auction or order book uncrossing.

3.4 Trade Traceability

T7 provides trade traceability, allowing orders to be linked to executions and trade confirmations. Please refer to section 5 for detailed information.

3.5 Clearing

Trade information is forwarded for clearing to the CCP and settlement to CREST.
Please refer to the section 5 for further information.

4 Interfaces

The T7 trading architecture provides members a portfolio of interfaces: Gateways act as entry points for transactions, public market and reference data are distributed using multicast, additionally a GUI solution is offered.

One general design principle of the interfaces is to minimise the impact on the members. Members do not need to install T7 specific hardware or software components. T7 can be accessed without the need for specific hardware, operating system, programming language, and compiler versions, as long as they support the general communication components, like TCP/IP and IP multicast.

The next figure followed by a brief overview describe all interfaces supported by T7:

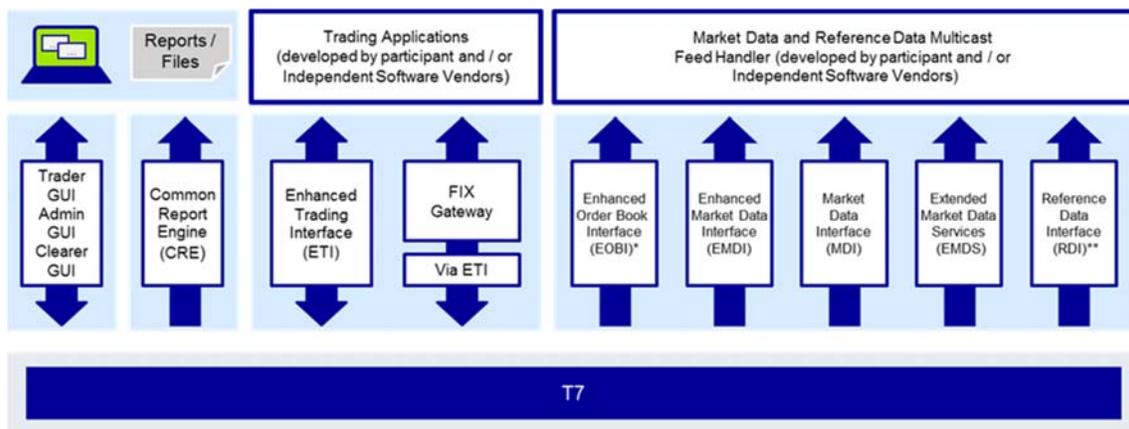


Figure 7: T7 Interface Landscape

* Available in co-locations only

** In addition to the multicast based solution there will also be a file based solution for reference data via the Common Report Engine (CRE) and an internet download

Trading Interfaces:

- **Enhanced Trading Interface (ETI):** ETI is the high performance trading interface designed for Members who require the highest throughput and the lowest latency. The ETI supports full trading functionality, including market making (quoting).
- **FIX Gateway:** The FIX Gateway is intended for Members who require a standard FIX connection to the exchange. Thereby, both versions 4.2 and 4.4 of FIX protocol can be used for trading. Market making (quoting) functionality is not supported by this interface.

Market Data:

- **Enhanced Order Book Interface (EOBI):** Provides the entire visible order book by distributing public and anonymous information on each individual order and quote in un-netted manner, along with all order executions and state information.
- **Enhanced Market Data Interface (EMDI):** Provides un-netted price level aggregated market data for *order book trading* using multicast technology.
- **Market Data Interface (MDI):** Provides netted price level aggregated market data using multicast technology.
- **Extended Market Data Service (EMDS):** This interface provides all trade prices as well as underlying data like indices.

Reference Data:

- **Reference Data Interface (RDI):** This interface provides reference data via high bandwidth connections.
- **Reference Data File (RDF):** Reference data is also delivered as a start-of-day file (RDF) including updated intraday files for incremental changes.
- **Reference Data via webpage:** Reference data is provided via the internet.

Graphical User Interfaces (GUIs)

- **GUIs (Trader/ Admin/ Clearer):** Graphical user interfaces for basic trading functions (Trader GUI) such as order maintenance. Quoting is not supported. The Admin GUI is provided for administration functions, such as for user maintenance, for example. The Clearer GUI is exclusively designed to manage the back office departments.

Reports

- **Common Report Engine:** Trading reports, audit trail reports, and the reference data file are provided exclusively via the common report engine.

The following table illustrates as a summary which functions are supported by each interface:

	Core Trading ¹	Market Making ²	Info ³	Market Data	Reference Data	Admin ⁵	Reports
ETI	✓	✓	✓				
FIX Gateway	✓		Private risk control messages				
MDI				✓ ⁴			
EMDI				✓ ⁴			
EOBI ⁶				✓ ⁷			
EMDS				trade prices			
Trader GUI	✓	Only quote deletion, activation/deactivation	✓	✓	✓		
Admin GUI						✓	
Clearer GUI			Private Trade Info			✓	
RDI					✓		
Common Report Engine					✓		✓

Table 43: Overview of Interfaces and Functions

¹ Order management, trade confirmations, cross request.

² Quote management.

³ Public news, private risk control messages.

⁴ Public market data, order book trade information, product and instrument states, cross requests.

⁵ User maintenance, password maintenance, PIN procedure, trade enrichment rule, stop trading, risk control actions.

⁶ For selected products only.

⁷ Does not provide off-book trade information.

4.1 Trading Interfaces

There are two types of trading interfaces: The Enhanced Trading Interface (ETI) and the FIX Gateway. Both are session oriented interfaces. Participants are requested to order their sessions via the Xetra member portal.

Participant applications are connected to the trading system by opening a TCP session to an application gateway.

4.1.1 The Enhanced Trading Interface

The Enhanced Trading Interface (ETI) is the high performance trading interface designed for Members who require the highest throughput and lowest latency.

A Member must establish a TCP session to connect to ISE T7. All application messages exchanged between the client and the ETI are close to the FIX V5.0 SP2 semantics, including all officially approved extension packs. A proprietary session layer is used to provide the highest flexibility.

ETI provides all trading functions of T7:

- Order handling.
- Additional support of short order message layouts, which applies streamlined functionality to achieve a comparable latency to quotes.
- Quote handling, including quote inactivation
- Execution notifications.
- Cross request.

ETI enables members to subscribe to private trading data in broadcast form:

- Drop copy of order events other than for lean orders (optional subscription).
- Trade confirmation at a business unit level (optional subscription).

The following trading support information is available for each session:

- News messages from market supervision (optional subscription).
- Private risk control messages (always sent).

ETI does not provide any market data, reference data, or administrative functions.

ETI is a session oriented interface. ETI responds to each request on the same session after the request was submitted. It also sends unsolicited messages when there are changes or executions to any orders and quotes entered on that session.

ETI is based on the following general concepts:

- Trade confirmations are the only legally binding information that a trade has occurred.
- Orders are owned by the user.
- Lean orders can only be modified through the same session, where they had been entered previously.
- Quotes are owned by the session.
- Order and quote responses as well as execution messages do not completely echo the data of the original order. Hence member applications should save the details of each order and quote sent.
- No state recovery (inquiry) is supported; Member applications must keep track of the order book and use retransmission recovery and the order book replay, which is sent at start-of-day and in case of an exchange system failure (i.e. market reset).
- For quotes and lean orders only the execution notifications and unsolicited events are recoverable.
- For standard (non-lean) orders all order events are recoverable.
- A listener broadcast contains order events for standard (non-lean) orders but not for lean orders (refer to 3.1).

ETI offers low-frequency (LF) sessions. A LF session may be used for the receipt of broadcasts; for example, listener broadcast or trade notifications at a business unit level/clearing member level. Orders in a LF session can be persistent or non-persistent, standard (non-lean) or lean, refer to 3.1.

In order to protect its trading system, T7 has several measures in place to ensure that its most vital components are not harmed by a malfunctioning client application. In particular, the following technical transaction limits (throttle) are used for the respective combinations of environment, session type and capacity type:

Environment	Session type	Capacity type	Transactions/sec
Production	LF	Full	150
	LF	Light	50
Simulation	LF	Full	20
	LF	Light	20

Table 54: Transaction Limits in Production and Simulation

Additionally, all ETI sessions have an assigned disconnection limit of:

- 450, i.e. in case of more than 450 consecutive rejects due to exceeding the technical transaction limit for sessions with a throttle value of 150 txn/sec.
- 150, i.e. in case of more than 150 consecutive rejects due to exceeding the technical transaction limit for sessions with a throttle value of 50 txn/sec.

For both limits all technical transactions are counted using a sliding window.

Dedicated back-office ETI LF sessions are available to receive trade and listener broadcasts. This session type cannot be used to enter order/quotes.

Please refer to the “T7 Enhanced Trading Interface Manual” for further details.

4.1.2 The FIX Gateway

The FIX Gateway is intended for Members that require a standard FIX connection to ISE T7. The FIX Gateway will support two types of FIX sessions; Trading and Back-Office FIX Sessions.

The interface is a point-to-point service based on the technology and industry standards TCP/IP, FIX and FIX Session Protocol. The session and application event models and messages are based on version 4.2 and 4.4 of the FIX Protocol.

The FIX Gateway supports the following features of T7 via FIX trading sessions:

- Order handling.
- Execution notifications are sent to the session where the order is submitted.
- Cross request.
- Enhanced support for mass deletion events (market reset, risk control events).
- Private risk control messages

Each FIX session has a technical transaction limit of 50 transactions per second.

Dedicated back-office FIX sessions are available to receive trade confirmations and drop copies of standard orders at a business unit level. The FIX Gateway does not provide quote functionality, market data, reference data, or administrative functions. Please refer to the “FIX Gateway Manual” for further details.

4.2 The Market Data Interfaces

Public market data is available using multicast interfaces:

- Enhanced Order Book Interface (EOBI) provides the entire visible order book by publishing information on each individual order and quote, along with executions and state information. It is the most granular source of order book market data. The EOBI requires a 10GB connection and is available in co-location installations only.
- Enhanced Market Data Interface (EMDI) offers un-netted market data and requires a high bandwidth connection.
- Market Data Interface (MDI) offers netted market data, with fewer order book and trade updates, requiring a lower bandwidth connection.

All data feeds are distributed over a number of IP multicast addresses which is available via RDI/ RDF.

4.2.1 Market Data Interface (MDI) and Enhanced Market Data Interface (EMDI)

The EMDI and MDI feeds follow FIX 5.0 SP2 semantics and are FAST encoded. EMDI uses out-of band recovery, while MDI uses in-band recovery.

The following information is provided:

- Netted (MDI) and Un-Netted (EMDI) price level aggregated market data less price levels are provided on the MDI feed, which can be different to the number provided on the current trading system.
- Product state and instrument state information.
- Order book trade information (EMDI: individual trade information, MDI: trade statistics only such as high, low, last etc.)
- Cross requests.

- The Market Data Interface consists of incremental messages (event driven) and snapshots (periodic generated) which will be delivered via one channel (in-band).

Please refer to the “Market and Reference Data Interfaces Manual”, which contains further details on the interface.

4.2.2 Enhanced Order Book Interface

EOBI is available for a selected product group. The EOBI feed is distributed in the form of fixed length binary messages, without any compression, and uses out-of-band recovery. Most of the functional concepts used are similar to those of EMDI, however the EOBI provides greater transparency, together with a high throughput at minimal latency. The following information is provided on the EOBI:

- Order book information, disseminated without any depth limitation.
- The side, price, priority timestamp and displayed quantity of each visible order and quote.
- Trade prices and traded quantity for each executed order book trade.
- Product state and Instrument state information
- Cross requests

The required reference data information is available via the Reference Data Interface (RDI) feed and the Reference Data Files (RDF). Please refer to the “Enhanced Order Book Interface Manual”, which contains further details.

4.2.3 Extended Market Data Service

Participants and CEF ultra+ clients can receive trade prices via multicast.

4.3 Reference Data

The following public reference data is provided to Members:

- Product information.
- Instrument information

Information is provided for published and active, but not for delisted products/instruments.

Please refer to the “Market and Reference Data Interfaces Manual”, which contains further details on the interface.

4.3.1 Reference Data Interface (RDI)

The Reference Data Interface (RDI) distributes data over a number of IP multicast addresses via high bandwidth connections. All feeds follow FIX 5.0 SP2 semantics and are sent with FAST encoding. Information is provided as regular snapshots containing information as of the beginning of the day.

4.3.2 Reference Data File (RDF)

Reference Data Files (RDF) are provided at the beginning of the day with the full set of products and instruments. The files are available on the common report engine.

4.4 Graphical User Interfaces

The Graphical User Interfaces (GUIs) provide Members with trading, market data and administrative and clearing related functions. The GUIs are started from a standard web browser with java web start.

The GUIs are based on web technology; there is no need to install software kits provided by the ISE or Deutsche Börse. The GUIs can be accessed by standard leased lines or via the internet. For authentication, user/password methods, and client certificate (only for internet access) technologies are used.

The Trader GUI provides access to the following functions for products and instruments traded on ISE T7:

- Market overview and depth.
- Maintenance of standard (non-lean) orders.
- View of standard (non-lean) orders of the business unit.
- Execution information for order book trading of the business unit.
- Cross requests.
- Quote deletion and activation/deactivation.
- Emergency risk control functions (panic cancel and stop/release button).
- Private risk control messages.
- General messages from market supervision.

Entry or query of Quotes or lean orders is not supported.

The Admin GUI contains the following functions:

- Administrative functions, such as creation of users, assignment of entitlements and transaction size limits.
- Trade enrichment rules setting
- Emergency risk control functions (panic cancel and stop/release button).

The Clearer GUI contains the following functions:

- Administrative functions for clearing
- Display of trades of related trading participants

For more information on the GUIs please refer to the “Trader, Clearer and Admin GUI - Manual”.

4.5 Reports

Trading reports, audit trail reports, and reference data files are provided via the Common Report Engine, where they can be retrieved by Members.

For details, please refer to the “Common Report Engine (CRE), User Guide”.

5 Appendix

This appendix contains detailed information on order, quote and trade traceability as well as clearing fields used by the clearing systems.

5.1 Trade Concepts

This appendix describes the order book matching and trade concepts relevant in ISE T7, including Match Event, Match Step, Execution, Trade, and Trade Item.

5.1.1 Direct Simple Instrument Match

The following diagram illustrates the concepts describing an instrument match in ISE T7. A direct match occurs when an incoming order matches against an order on the opposite side of the order book.

When an incoming order is executed, a Match Event is generated, representing the entire execution. Every price level executed in the match event is called a Match Step, and is assigned a unique Match Step ID.

A Match Step is the total aggregated quantity executed at one price level in a Match Event. For example, Match Step 01 containing a traded volume of 80 at price 17 is generated when incoming Order 4 (Sell 100@16) matches with Orders 2 (Buy 50@17) and 3 (Buy 30@17) in the order book. A second Match Step 02 containing a traded volume of 20 at price 16 is generated when the remaining quantity of Order 4 matches with Order 1 (Buy 20@16). All Match Steps are published in the Public Trade Volume messages.

Each Match Step is broken down into Order Executions, wherein one execution is generated for every order executed at every price level. For example:

- Order Execution 01, Trader A buys 50 @ 17 (Order 2)
- Order Execution 02, Trader B buys 30 @ 17 (Order 3)
- Order Execution 03, Trader D sells 80 @17 (Order 4)
- Order Execution 04, Trader C buys 20 @ 16 (Order 1)
- Order Execution 05, Trader D sells 20 @ 16 (Order 4)

Order Event messages are sent to the trader for every one of their orders involved in a Match Event, including all its executions. One Order Event message is generated per order, for example, one Order Event to Trader D containing both executions of Order 4.

Based on Match Steps, Trades are then generated and assigned unique Trade IDs. T7 distinguishes thereby between two different trade processing methods, which can be set for each instrument separately:

- Price level aggregated trades, and
- Trades based on single executions

Trades based on single executions is applied for all instruments on ISE T7. Under this trade processing method, trade confirmations are generated on the basis of bipartite trades. Each trade contains bilateral trade sides, i.e. the same quantity of the buy and sell side. Unlike the Price level aggregated trade rule which is being applied to the Xetra cash market, the procedure being applied to the ISE T7 market can lead to multiple order executions within the same Match Step.

Figure 8 below illustrates the process for the Xetra cash market, while **Figure 9 illustrates the process for ISE T7.**

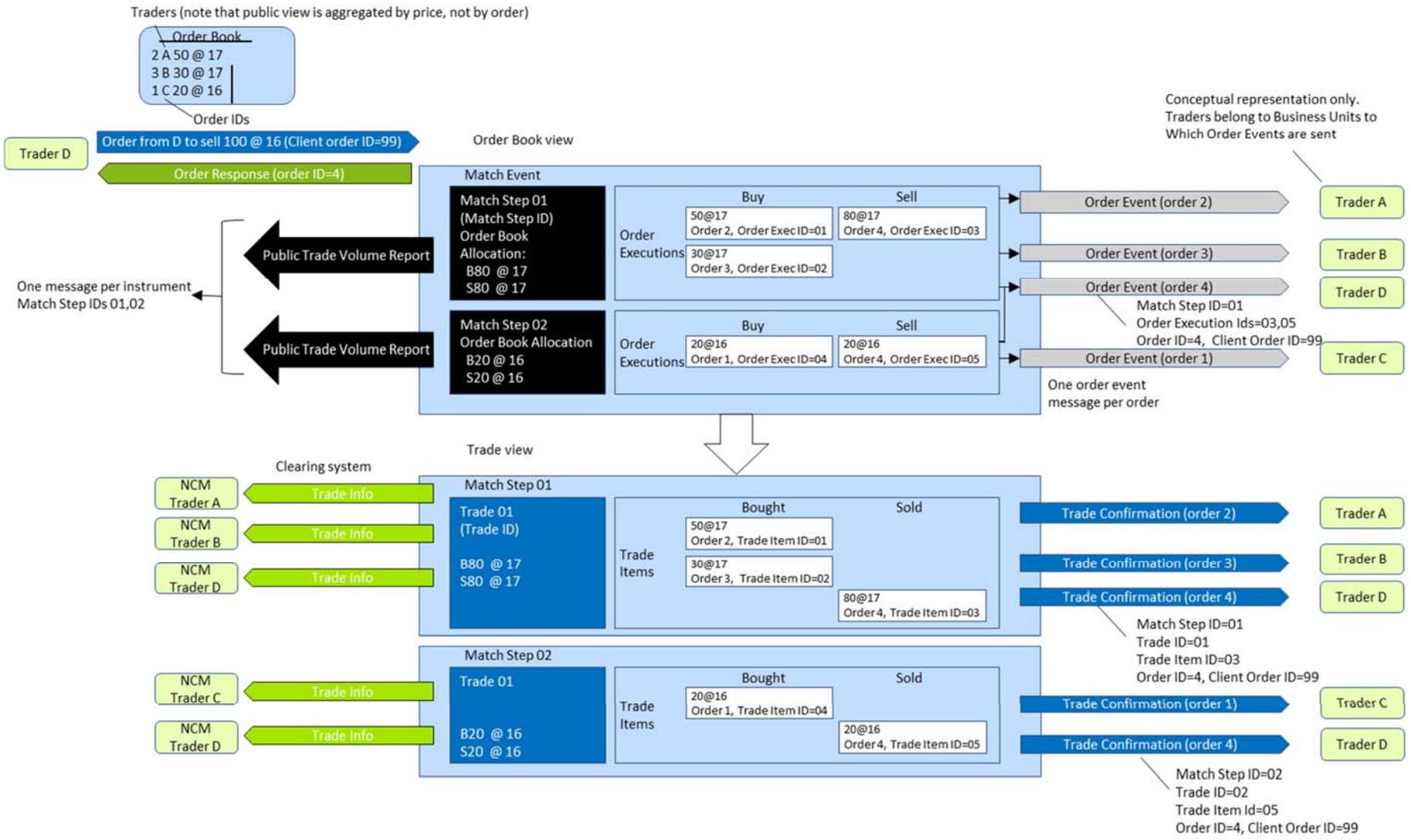


Figure 8: Example for Price Level Aggregated Trades

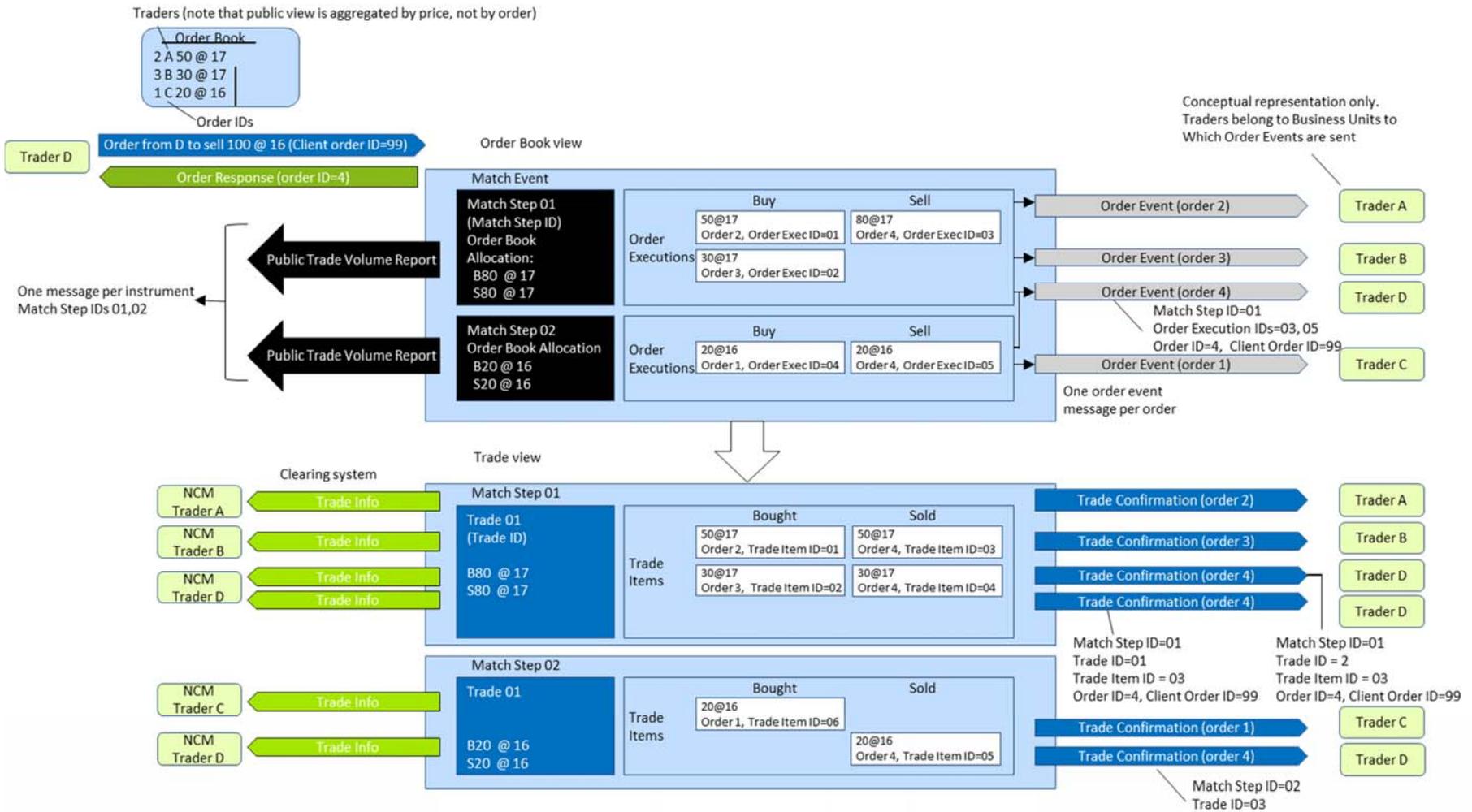


Figure 9: Trades Based on Single Executions

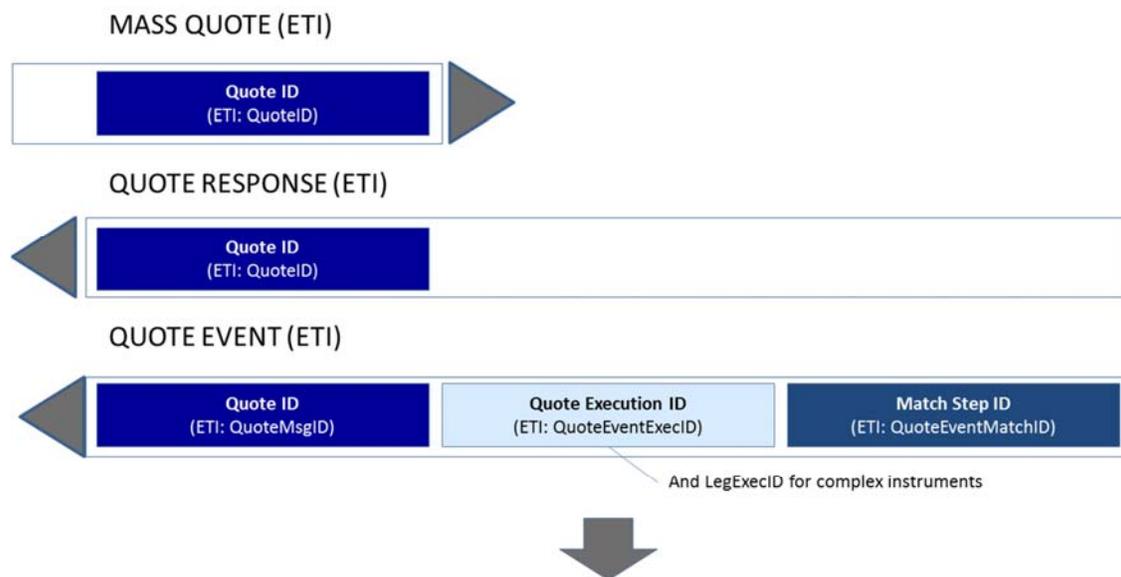
5.1.2 Quote Traceability

The following diagram shows the key identifiers available for quotes and how Members can use them to cross reference the various response messages.

T7 supports quotes via the ETI Interface only. One or more quotes can be entered in a Mass Quote, for which Members provide a Quote ID for the entire Mass Quote (i.e. not per individual quote). This Quote ID is returned on the Quote Response as well as any Quote Events for executed quotes. Quote IDs are not checked for uniqueness.

For every match event, the system assigns identifiers, unique within product and business day, to each aggregated price level (Match Step ID) and every execution (Quote Execution ID).

Subsequent Public Trade Volume, Trade Confirmations, and Trade Information are provided using the same messages as with orders, refer to section **Error! Reference source not found.**



Refer to section Order Traceability diagram for Public Trade Volume, Trade Confirmation and Trade Information

Figure 10: Quote Traceability

5.1.3 Trade Reversal

When a trade is reversed, T7 sends Members a Trade Reversal message containing a new Trade ID. For traceability, the original Trade ID is also provided. The following diagram shows how to trace the trade identifiers in the case of a reversal.



Figure 11: Trade Reversal

5.2 Traceability with CCP

This appendix describes how to reference order, quote and trade messages using identifiers supported by T7 and how they can be linked to the trade messages from the counterpart CCP, applicable to all order book trades.

5.2.1 Order Traceability

Each order entered in T7 is assigned by a unique Order ID and a System Order ID Version Number. While the Order ID is the same during the lifetime, the System Order ID Version Number increases in case of a user driven order modification with a priority change.

When an order is executed, the trader is informed via an order execution confirmation. For each price level (match step), the execution confirmation includes a unique ID called Match Step ID. This field can be used as a linkage between the public market data and the Trade Notification.

In addition to the Match Step ID, the execution confirmation include the Order Execution ID which can be also used for mapping with the Trade Notification by the field Trade Item ID.

The Trade Notification of T7 is enriched by an additional field called Side Trade Report ID. This field is equal to the Trading Number used in the Trade Report of CCP for clearing and settlement.

Please note that within the trade confirmation sent to the clearing and settlement, the Order ID is converted since the field length in the clearing and settlement systems is limited to 13 alphanumerical. The conversion is done by using the Horner scheme to recalculate the Order ID, which is expressed as decimal number (i.e. basis of 10), to the basis of 36. This information is useful if the mapping from CCP back to T7 is requested, then the conversion has to be conducted back. For more details, please refer to the Enhanced Trading Interface Manual.

The following diagram shows the key identifiers available in the system for on-book trading and how Participants can use them to cross reference the various response messages:

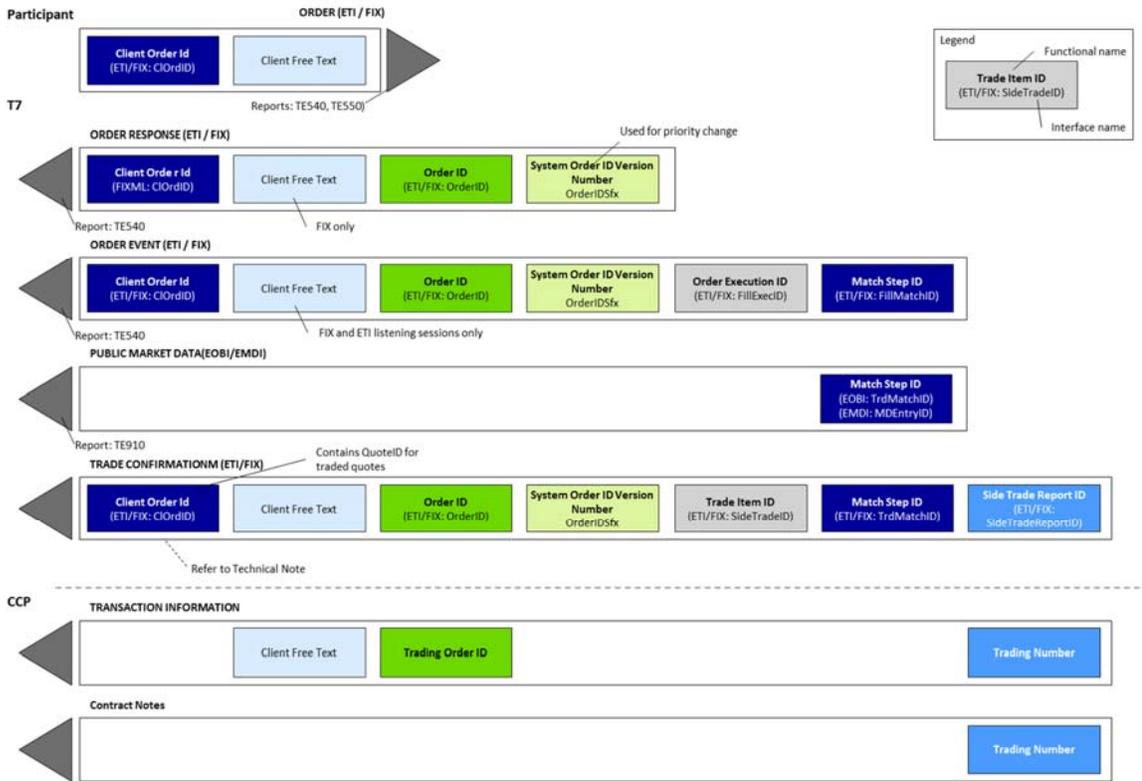


Figure 12: Tracing of orders and trades

*Same content information reflected by the same colour and position of the respective boxes

5.2.2 Quote Traceability

When a quote gets executed, the trader is informed via the quote execution notification. Similar to orders, the execution notification for quotes is sent for each price level (match step) and include the fields Match Step ID and the Quote Execution ID. While the Match Step ID is used for public trade reporting, the Quote Execution ID is the private identifier for the quote match and can be reconciled with the field Trade Item ID in the Trade Notification. For a mapping regarding to CCP, the Trade Notification is enriched by the additional field Side Trade Report ID (see also order traceability) which in turn is the Trade Number in CCP Trade Report. Please note, similar to order traceability with CCP, that the Order ID is converted to a field length of 13 due to limitations in the clearing system (refer to section 5.2.1). For more details, please refer to the “Enhanced Trading Interface” Manual.

The following figure represents a quote match event:



Refer to section Order Traceability diagram for Public Trade Volume, Trade Confirmation and Trade Information

Figure 13: Quote Traceability with CCP