

Eurex Exchange's New Trading Architecture

The next generation in derivatives trading

Part 3 – Technical Characteristics

June 2012



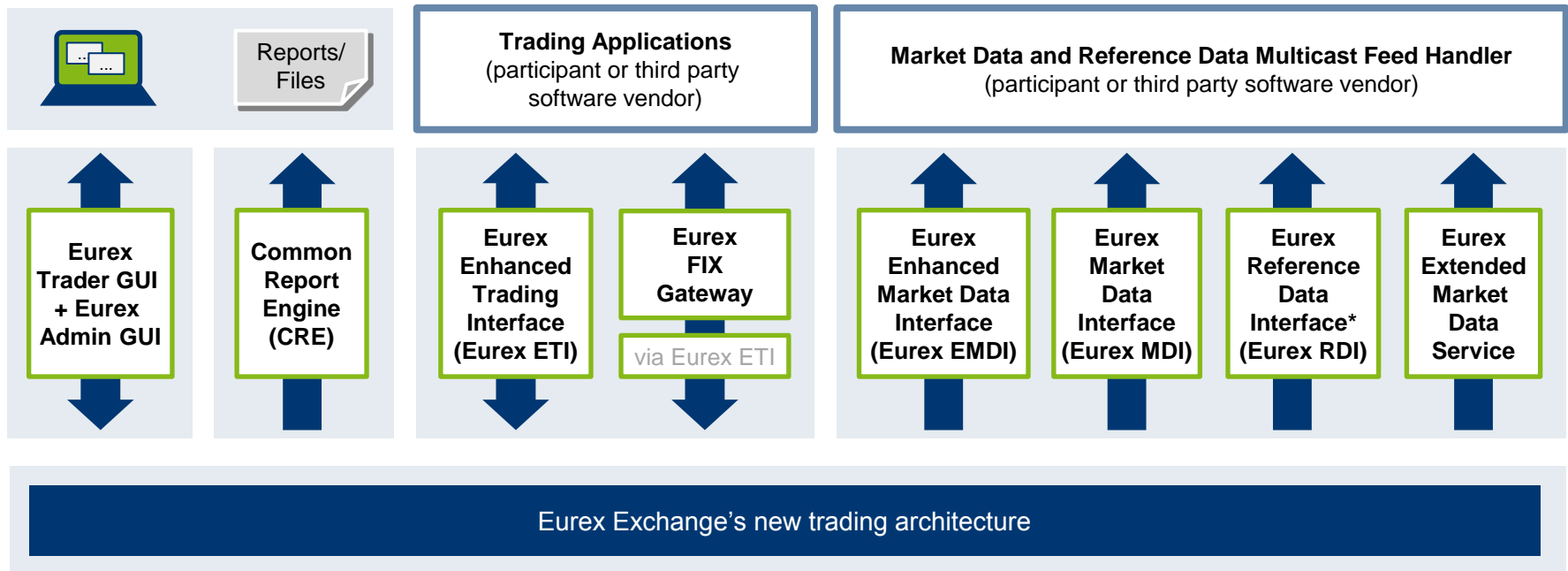
Agenda

- New interfaces
- Technical aspects of the new GUI solution
- Reports and files – Common Report Engine
- Eurex FIX Gateway
- Eurex Enhanced Trading Interface
- Eurex Market and Reference Data Interfaces
- Connectivity
- Further information

New interfaces

Interface landscape of Eurex Exchange's new trading architecture

- New GUI solutions for trading and administration – Eurex Trader GUI and Eurex Admin GUI.
- Distribution of reports and files only via Common Report Engine – no support of MISS infrastructure.
- New trading interfaces – Eurex Enhanced Trading Interface (Eurex ETI) and Eurex FIX Gateway.
- New market data interfaces for netted and un-netted market data and new reference data interface.
- No support of VALUES API for trading.



*In addition to the multicast based solution there will also be a file based solution for reference data.

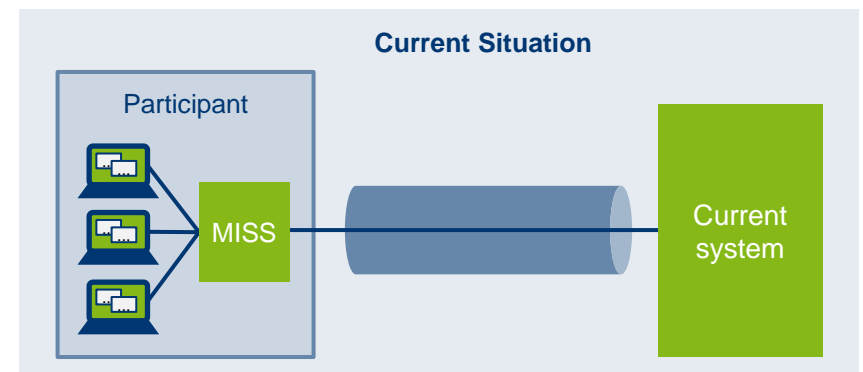
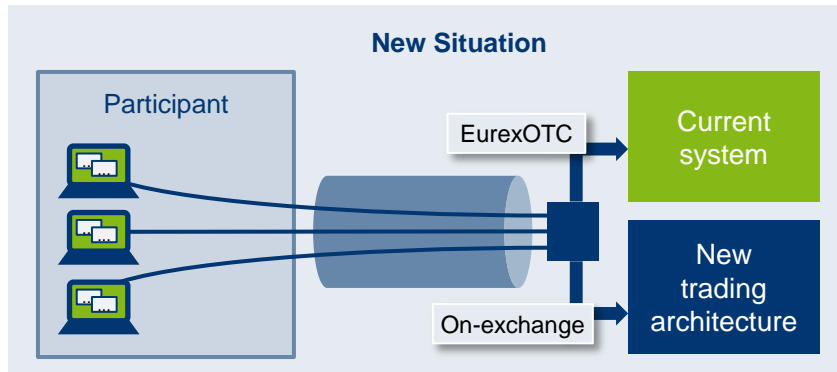
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New GUI solution

Technical aspects

- New GUI solution based on web technology:
 - No need for installation of front-end software.
 - GUI frontend updated by Eurex as latest version will be downloaded automatically.
 - Only internet connections require a certificate for client authentication – similar to Common Report Engine and FIXML Interface.
- Connectivity:
 - No MISS used as concentrator for market data provided to the GUIs, thus bandwidth requirements are increasing with number of open screens.
 - Access via leased lines and internet possible.



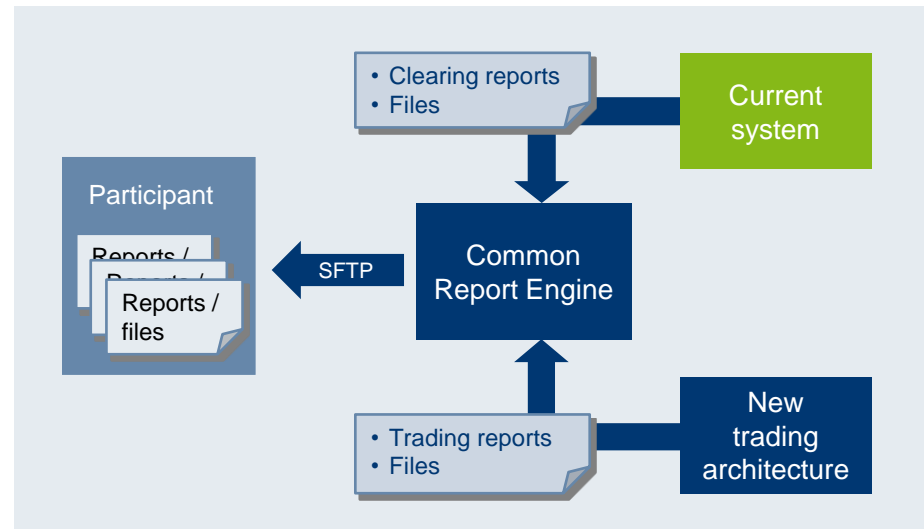
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Reports and files

Common Report Engine

- The Common Report Engine will be the sole source for reports and files from Eurex Exchange's new trading architecture – the MISS infrastructure will not be supported.
- If already established, access to the Common Report Engine can be used further.
- Reports to come from the new trading architecture and the current system.
 - Trading reports for products traded on the new trading platform by the new trading platform.
 - Trading reports for products traded on the current system by the current system (during the product migration period).
 - Clearing reports for products on new and current system from current system.
- Reports from new trading architecture:
 - Daily order maintenance,
 - Cross and quote requests,
 - Futures price movement summary,
 - User security maintenance,
 - ...
- Reports provided by current system:
 - Trade report,
 - EurexOTC trade maintenance report,
 - Position report,
 - ...



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Eurex FIX Gateway

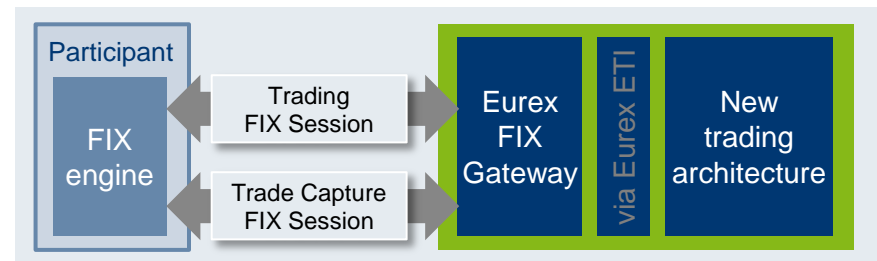
Interface characteristics and FIX sessions

Characteristics

- Standard session-based FIX interface supporting FIX versions 4.2 and 4.4.
- Provides trading functionality for on-exchange trading on the new trading architecture.
 - Does not support quoting functionality.
 - Does not support EurexOTC Trade Entry service.
 - Does not provide market / reference data.
- Based on FIX Gateway introduced with Eurex Release 14.0.
- Enhancement of functionality to support new Eurex trading architecture.
 - Enhanced information on mass cancellation events (e.g. in case of a market reset).
 - Simplified handling of multi-leg-instruments (requires participants to receive and process intra-day reference data).

FIX session concept

- FIX sessions identified by FIX session ID (SenderCompID) and password.
- Separate FIX sessions required for connection to the new trading architecture.
- Trading FIX session:
 - Used for order management.
 - A session only receives information for all of its own orders and their executions*.
 - One session can be shared by several traders.
- Trade Capture FIX session:
 - Used for trade capture at a business unit level.



*All responses are optimistic. Only trade capture reports are legally binding.

Details to the Eurex FIX Gateway on the Eurex website:

- www.eurexchange.com > Member Section > New Trading Architecture > Trading Interfaces > Eurex FIX Gateway

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- New interface landscape
- Technical aspects of the new GUI solution
- Reports and files – Common Report Engine
- Eurex FIX Gateway
- **Eurex Enhanced Trading Interface**
 - Interfaces characteristics
 - Technical features
 - Session concept
 - Order and quote response
 - Order book restatement
 - Failover concepts
- Eurex Market and Reference Data Interfaces
- Connectivity
- Further information

Eurex Enhanced Trading Interface

Interface characteristics

- High performance interface for highest throughput and lowest latency.
- Full trading and quoting functionality for on-exchange trading on new trading architecture.

Supported functionality

- Order handling for simple and complex instruments.
- Quote handling with quote activation / de-activation.
- Market maker protection parameter maintenance.
- Quote and cross requests.
- Full support for the creation of complex instruments (strategies).
- Execution notifications.
- Drop copy for order history of standard orders (listener broadcast).
- Trade notifications (trade broadcast).
- Eurex Market Supervision news and risk control messages.

Restrictions

- Does not support EurexOTC Trade Entry services.
- Does not provide market / reference data.
- No support for administrative functions (i.e. user maintenance / entitlement).
- No state recovery (inquiry) supported for orders, quotes and instrument states.

Details to the Eurex Enhanced Trading Interface on the Eurex website:

- www.eurexchange.com > Member Section > New Trading Architecture > Trading Interfaces > Eurex Enhanced Trading Interface

Eurex Enhanced Trading Interface

Technical features

- **Message based** – Eurex ETI is an asynchronous, message-based interface. Connection between participant and new trading architecture established via TCP/IP session.
 - Low footprint: no special hardware required; no exchange software to be installed; free choice of operating system, programming language and compiler versions.
 - Adoption of standards: messages follow semantics of FIX standard V5.0 SP2 (including officially approved extension packs).
 - Performance oriented: proprietary session layer and flat binary encoding (defined order of fixed-length fields and arrays of fixed-length elements).
- **Session oriented** – Eurex ETI based applications receive information on orders/quotes and their executions which were entered in their own session.
- **Subscription mechanism** – Eurex ETI provides information across sessions via a subscription mechanism for broadcast streams.
- **Throughput limits / throttle** – the number of transaction requests transmitted to the new trading architecture per time interval by each participant session is limited.
- **Full control in case of a failover** – participant applications will be required to take full control of failover. Heartbeats can be used to support detection of malfunctions between the client application (trading session) and the Eurex gateway.

Eurex Enhanced Trading Interface

Session concept – functional background

- Two order attributes define different order characteristics

Standard orders versus lean orders

- **Standard (non-lean) orders:** complete order history of an order will be part of the listener broadcast and may be recovered via retransmission requests.
- **Lean orders:** receipt of status information restricted to the owning session. Only execution notifications and unsolicited events in the session scope may be recovered via retransmission request. All lean orders are non-persistent and GFD.

Persistent versus non-persistent orders

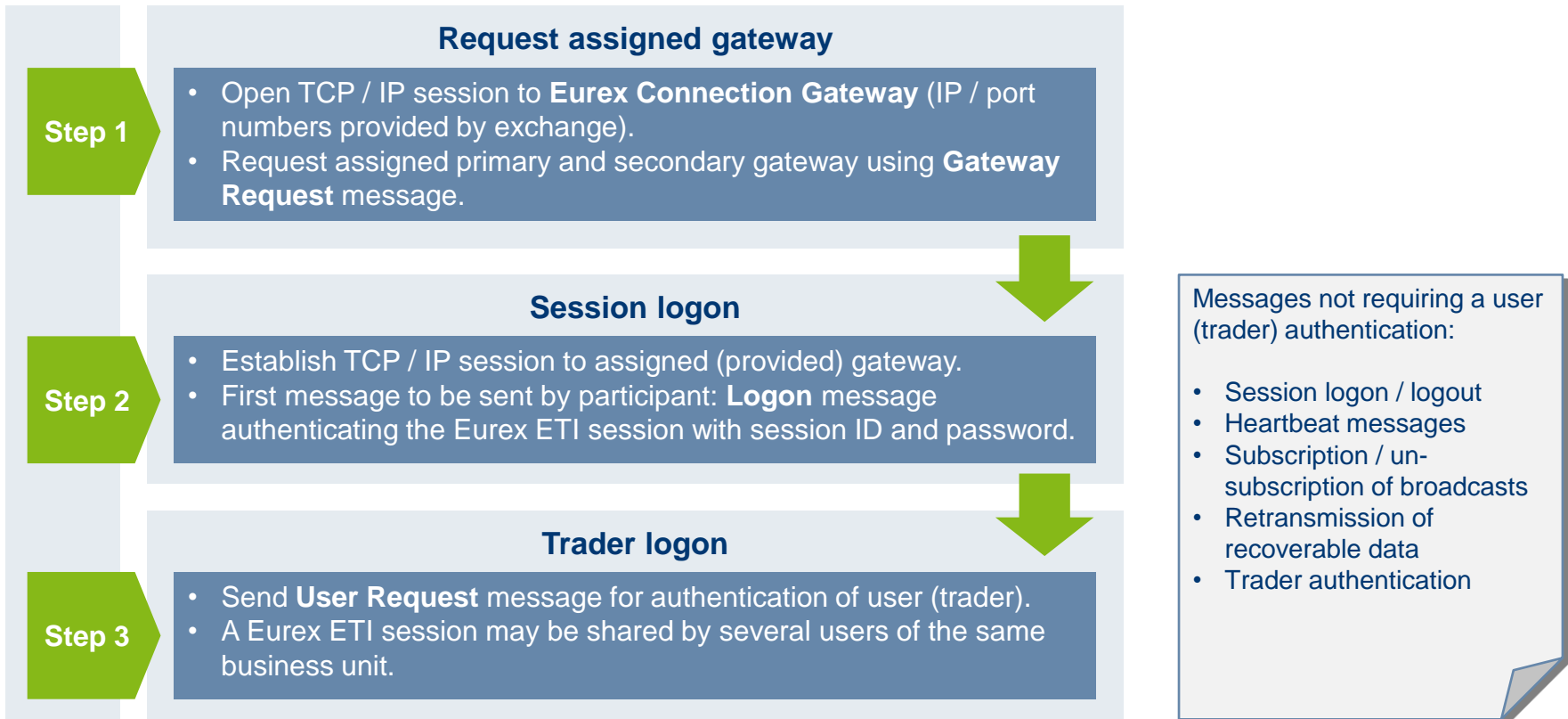
- **Persistent orders:** orders are still available after a market re-set, volatility interruption or a state change to "Halt". After a market reset as well as at start-of-day a order book replay is provided. All GTD and GTC orders are persistent.
- **Non-persistent orders:** non-persistent orders are deleted in case of a market reset, volatility interruption and state change to "Halt".

Quotes are always non-persistent.

- Ownership of orders and quotes
 - Orders are owned by the user within a session.
 - Quotes are owned by the session.

Eurex Enhanced Trading Interface

Session concept – three step logon procedure



Note: There are separate technical infrastructures for HF and LF gateways with different IP address ranges / ports compared to the current Enhanced Transaction Solution infrastructure (more details on HF and LF sessions below).

Eurex Enhanced Trading Interface

Session concept – throughput limits / throttle

- Application may send multiple messages without waiting for a response.
- Throttles control number of messages allowed per timeframe but do not guarantee throughput rates, similar to today's throttle in the Eurex Enhanced Transaction Solution.
- Throttle values configured for each session type and provided in logon response message.

Two components used for throttle mechanism

Outstanding message limits

- Update: The formerly announced concept of the maximum number of messages for which no response has yet been received by the participant will not be implemented.

Transaction limit

- Maximum number of messages a participant application may send within a configured time interval, e.g. 150 messages / second.
- Heartbeats do not count.
- Requests exceeding the limit will be rejected.

Reject / disconnect limit



- Protects the gateway from large amounts of invalid data and will disconnect session once exceeded.
- Disconnects session if limit exceeded.

Note: HF sessions and LF sessions differ in number of maximum requests/messages per time interval.

Eurex Enhanced Trading Interface

Session concept – high and low frequency sessions

- Receiver of direct response to a request sent to the gateway is always the submitting session.
- Session is informed about system events and all unsolicited messages (status changes) of its orders and quotes.
- Functionality supported by the HF and LF session types varies:

Functionality	Low Frequency Session (LF)	High Frequency Session (HF)
Standard Order (non-lean) 	Yes	No
Lean Order	Yes	Yes
Persistent Order 	Yes	No
Non-persistent Order	Yes	Yes
Quotes	Yes	Yes
<u>Update</u> : Modification “on behalf” functionality*	Yes (for standard orders)	No
Delete “on behalf” functionality*	Yes	<u>Update</u> : No Yes (for mass cancellations)
Listener Broadcast (order history)	Yes	No
Trade Broadcast	Yes	No
News Broadcast	Yes	No
Risk Control Broadcast	Yes	Yes
Service Availability Broadcast	Yes	Yes
Order Validity Types	GTD, GTC, GFD, IOC, ...	All except GTD and GTC

* Please note, “On-behalf” means on behalf of another session. “Delete” includes also the de-activation and re-activation functions for quotes.

Eurex Enhanced Trading Interface

Session concept – broadcast streams

- Broadcast types: Eurex ETI supports a subscription mechanism for the receipt of broadcast streams (via LF sessions).

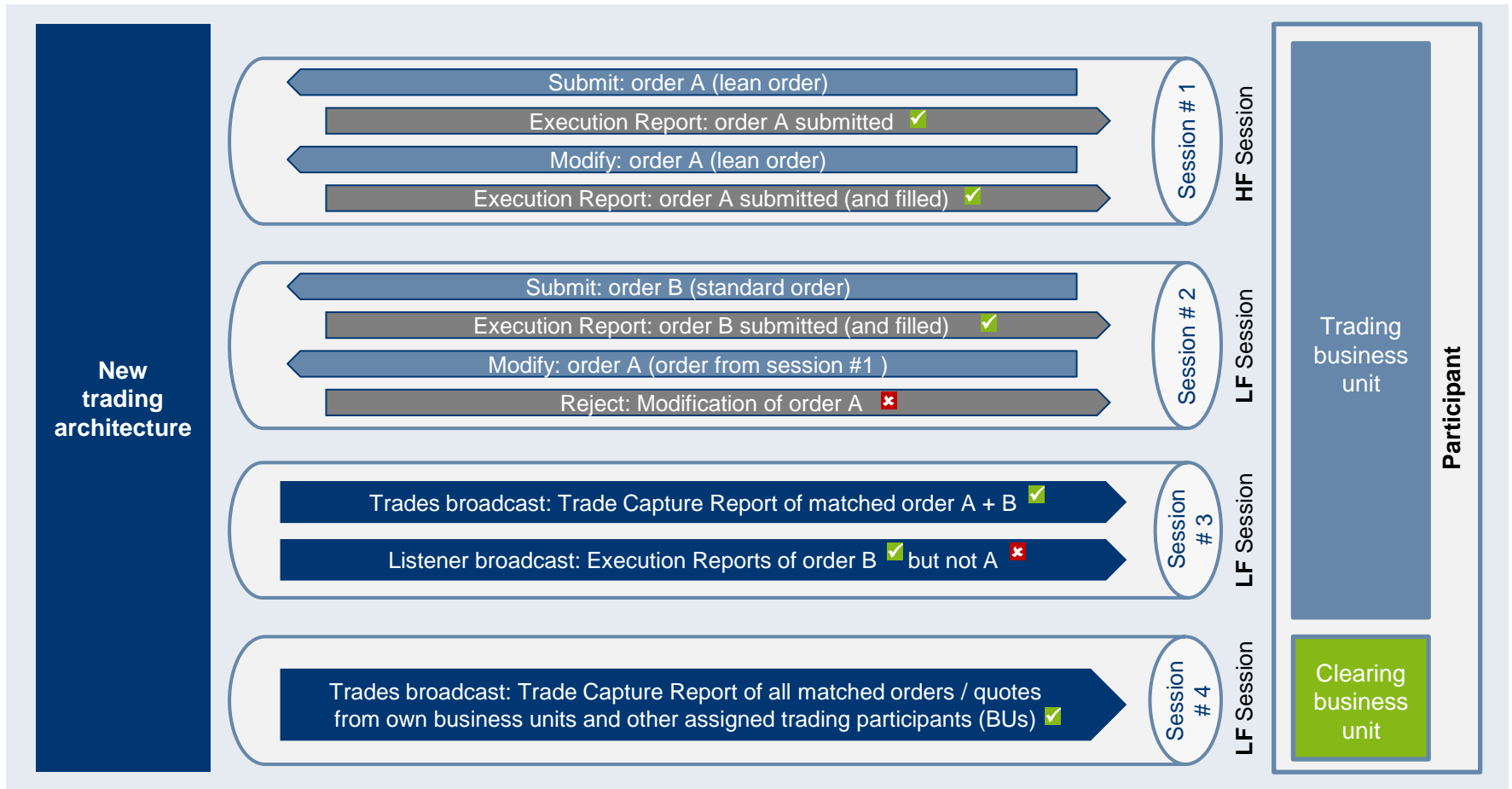
Broadcast	Description
Listener	<ul style="list-style-type: none"> • Recoverable order history “drop copies” for standard orders (not lean orders) to another session within the same business unit. • Provided on session level; each listener session may subscribe to a number of sessions (one to all) of a business unit.
Trades	<ul style="list-style-type: none"> • Trade data on business unit level.
News	<ul style="list-style-type: none"> • Public general messages from Eurex Market Supervision.
Risk Controls*	<ul style="list-style-type: none"> • Private risk control messages (legally mandatory for all sessions, therefore no subscription).
Service Availability*	<ul style="list-style-type: none"> • Provides information on the availability of a technical partition.

- A session is established, it is not subscribed to any broadcast; nevertheless unsolicited session data, e.g. executions of passive orders or on-behalf deletions, is received.
- All subscriptions are system-wide by default. For the Service Availability broadcast, a specific partition or partitions can be specified.

* Services also available via HF sessions.

Eurex Enhanced Trading Interface

Session concept – example for usage of lean and standard order types in sessions



Eurex Enhanced Trading Interface

Order and quote response

- Order / quote response information (execution report) is sent out immediately after the order or quote has been processed by the new trading architecture matcher.
- All order / quote response information is preliminary.
 - Order / quote response execution information is always preliminary. Only the corresponding Trade Capture Report (sent via Trades broadcast) is legally binding.
 - Market data is based on order execution information. Market data interfaces provide trade price messages on the basis of preliminary information.
- Limited order and quote response.
 - Order / quote responses are only sent within the initiating session.
 - Execution reports do not echo all data of an order / quote (e.g. no quantity, price, etc.). Therefore, participants' applications are required to maintain the state of orders / quotes.
 - Listener broadcast contains all order parameters (different layout compared to direct response).
- Execution reports are sent out for persistent and non-persistent orders and quotes.
 - In the event of a market re-set, execution reports with a message key higher than the last persistent message key (provided via a trading session status message) must be verified via Trade Capture Reports.

Eurex Enhanced Trading Interface

Order book restatement

- No order status inquires.
 - Order status inquiries are not supported by the Eurex ETI.
 - Participants must maintain the state of orders based on the Execution reports.
 - For lost order information, participants must rely on retransmission recovery and the order book restatement.
- Order book restatement.
 - Sent at start-of-day and in case of an exchange system failure, i.e. a market reset.
 - Order book restatement messages provide execution reports for each restated order.
 - Restatement messages are only sent for persistent orders. There is no restatement for quotes and lean orders, as no quotes and lean orders exist at start-of-day or they are deleted in case of a market reset.
 - Order book restatement messages are also sent on the listener broadcast.
- Retransmission request of restatement messages.
 - Order book restatement messages are recoverable*.
 - The owning session can request a retransmission if it was not logged on at the time.

* Retransmission requests are also supported for broadcasts (Listener, Trades, News and Risk Control).

Eurex Enhanced Trading Interface

Failover concepts

- Two groups of Eurex ETI gateways.
 - Both groups of gateways are built redundantly.
 - Each group can be reached only via one participant line/connection.
 - Two lines highly recommended to ensure access in case of a line failure.
- Network failover
 - Eurex ETI sessions will be disconnected from the gateway.
 - No automatic session failover if a connection to the gateway is lost.
 - Application requires failover mechanism to establish an ETI session over the alternative connection to the secondary gateway.
- Application failover
 - Active sessions will be disconnected upon gateway failure.
 - Application can:
 - either establish an ETI session over the alternative connection to the secondary gateway,
 - or reconnect to the Connection Gateway, resend the Gateway Request message and receive a new primary gateway assignment and then establish an ETI session to the new primary gateway.

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 - Three multicast-based market and reference data interfaces
 - General interface characteristics
 - Major differences between Eurex EMDI and Eurex MDI
 - Specifics of the Eurex Reference Data Interface
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New market and reference data interfaces

Three multicast-based market and reference data interfaces

Eurex Enhanced Market Data Interface (Eurex EMDI)

- Provides un-netted, price level aggregated on-exchange market data for new trading architecture.
 - Market depth: configurable per product.
 - Snapshots and incremental market data messages delivered via separate channels (out-of-band).
 - No historical public market, no replay mechanism.
 - High bandwidth requirements compared to lower bandwidth requirements for Eurex MDI and significantly more messages than the current Enhanced Broadcast Solution.
- Update: EurexOTC trade price information will be provided using the Eurex EMDI/MDI message structure.

Eurex Market Data Interface (Eurex MDI)

- Provides netted, price level aggregated market data on-exchange market data for new trading architecture.
- Top-of-book market depth for options; market depth of up to 10 for futures.
- Snapshots and incremental market data messages delivered via one channel (in-band).

Eurex Reference Data Interface (Eurex RDI)

- Provides start-of-day reference data and intraday updates.
- Snapshots and incremental ref. data messages delivered via separate channels (out-of-band).

Note: Ticker data (information about Eurex internal and external instruments, e.g. indices) will initially continue to be provided via the existing Market Data Interface (via existing mechanism).

New market and reference data interfaces

General interface characteristics

- Consist of Incremental messages (event driven) and snapshots (generated periodically).
- Identical message layouts for all interfaces (except of block header), based on FIX semantics 5.0 SP2 with FAST 1.1 and FAST 1.2 templates, separate for each interface, provided in XML format.
- Multicast IP address scheme: both market data interfaces will use different multicast addresses and port combinations compared to the current Enhanced Broadcast Solution.
- Both market data interfaces disseminate order book updates, product and instrument states, cross / quote requests and information relating to newly created / deleted complex instruments.
- A and B stream:
 - All feeds sent on two multicast addresses via different channels (service A + B); both services identical in packet contents, sequence numbers and package sequence.
 - Depending on the partition, market data will either originate first either on the A-Stream (even partitions) or the B-Stream (odd partitions), therefore both streams should be subscribed simultaneously.
 - Packet Header contains a sender ID which together with a sequence number is unique (for a given multicast address and port combination) allowing detection of duplicates and missing packets.

New market and reference data interfaces

Major differences between Eurex EMDI and Eurex MDI

Characteristic	Eurex EMDI	Eurex MDI
<ul style="list-style-type: none"> Netting interval / market depth 	<ul style="list-style-type: none"> All order book changes and on-exchange trades without netting. Fully configurable, similar to the existing Eurex Enhanced Broadcast Solution. 	<ul style="list-style-type: none"> Interval of 0,25 seconds for benchmark futures with market depth of 10. Interval of 2 seconds and only top-of-book for other products.
<ul style="list-style-type: none"> Snapshot processing 	<ul style="list-style-type: none"> Snapshots required for start-of-day and recovery only. Snapshot and incremental messages must be synchronized during start-of-day or during recovery. 	<ul style="list-style-type: none"> No synchronization of messages required as in-band delivery is used but snapshot messages must be processed.
<ul style="list-style-type: none"> Snapshot / incremental sequence numbers 	<ul style="list-style-type: none"> Individual sequence number range per product. 	<ul style="list-style-type: none"> One sequence number range per product.
<ul style="list-style-type: none"> Trade volume reporting 	<ul style="list-style-type: none"> Each on-exchange trade is reported separately. Trades appear first followed by order book updates in one template. 	<ul style="list-style-type: none"> Statistical information (daily high / low and total traded quantity) and last trade information only.
<ul style="list-style-type: none"> Packet header 	<ul style="list-style-type: none"> A performance indicator is provided for incrementals within the packet header. 	<ul style="list-style-type: none"> No performance indicator.
<ul style="list-style-type: none"> Functional heartbeat 	<ul style="list-style-type: none"> A functional heartbeat message on a product level + the last valid MsgSeqNum. 	<ul style="list-style-type: none"> Snapshots represent functional heartbeat messages.
<ul style="list-style-type: none"> Technical heartbeat 	<ul style="list-style-type: none"> Technical heartbeats (FAST reset messages) sent periodically on all multicast / port combinations to verify technical connection. 	

New market and reference data interfaces

Specifics of the Eurex Reference Data Interface

- Eurex RDI – reference data snapshot feed
 - Publishes product, instrument, market information etc.
 - Publishes technical reference data such as multicast address and port information.
 - Intraday incremental updates are applied to start of day reference data.
 - Message sequencing is on a per channel basis.
 - Previous days settlement price and open interest information is provided
 - Update: Intraday settlement prices and open interest information is provided
- Eurex RDI – reference data incremental feed
 - Informs about intra-day creation / deletion of complex order books via incremental messages.
 - Reference data incremental messages (if required for strategies) must be appended to the end of the reference data snapshots.
- Alternative: reference data file based solution
 - Reference data will also be provided in the form of a start-of-day file and regularly updated intraday files (addition and deletion of complex instruments).
 - Files are in compressed FIXML format.
 - Available via the Common Report Engine prior to the start of the market data infrastructure.

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 - Increased bandwidth requirements
 - Network upgrade and new connectivity concept
 - Pricing for new connectivity
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Connectivity

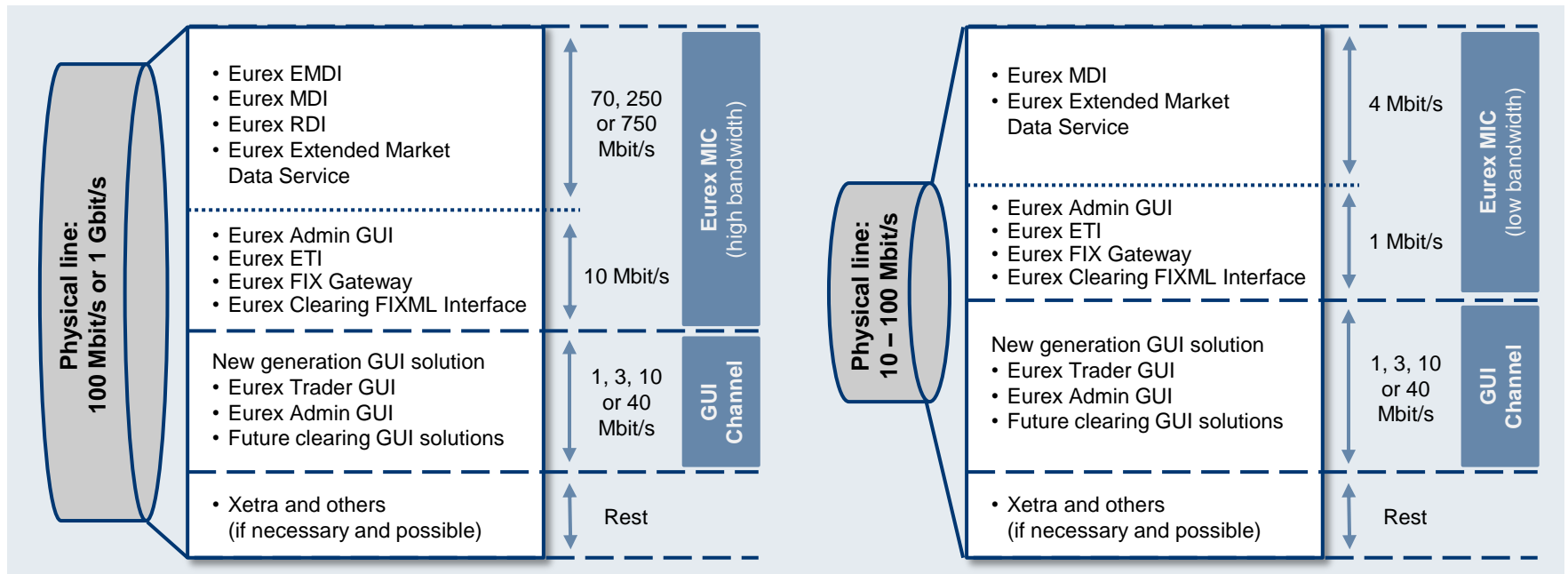
Increased bandwidth requirements

- Increased bandwidth requirements with Eurex Exchange's new trading architecture.
- Both market data interfaces (Eurex EMDI and Eurex MDI) will require increased capacity due to improvement in system throughput and potential launch of new products.
- Significant increase in the netted and un-netted market data volume.
 - Increased system performance will cause all price updates to be disseminated.
 - Increased trading activity as a result of improvement in system throughput.
 - Create additional capacity for the potential launch of new products.
- New GUI concept will change bandwidth requirements.
 - No component on the participant side to “fan-out” market data internally.
 - Each open GUI requires it's own dedicated connection to the GUI infrastructure.
 - Bandwidth requirements depend on number of open GUIs.

Connectivity

Network upgrade and new connectivity concept

- Connectivity concept
 - Compulsory (physical) network upgrade of up to 1 Gbit/s or 10/100 Mbit/s or at least E1 / T1 full capacity, depending on the participants locations.
 - Extension of Multi Interface Channel (MIC) concept for high bandwidth to include un-netted market data and reference data and new trading interfaces.
 - Replacement of “Pipe” concept and FIX channel with new high bandwidth MIC.
 - New GUI channels of 1 Mbit/s, 3 Mbit/s, 10 Mbit/s or 40 Mbit/s in addition to MIC for next generation GUI solutions.



Connectivity

Pricing for new connectivity – valid from April 1, 2013

Service	Bandwidth (Mbit/s)	Prices* of connections (EUR/month)								
		Co-Location (Equinix)	Access Point (London)	Leased Line in Tier A1	Leased Line in Tier A2	Leased Line in Tier B1	Leased Line in Tier B2	Leased Line in Tier C	Leased Line in Tier D	iAccess
Eurex Multi-Interface Channel (MIC)	1.5 (U.S.)	-	-	-	750	-	750	-	-	500
	2	-	-	-	-	-	-	-	750	500
	5	750	750	750	-	750	-	750	-	500
	80	3,000	3,600	4,500	4,500	8,100	8,100	9,200	-	-
	260	4,000	4,600	5,800	-	9,900	-	11,000	-	-
	760	5,000	5,600	7,000	-	11,600	-	12,800	-	-
Co-Location	Mkt. Data Eurex EMDI	10,000	4,500	-	-	-	-	-	-	-
	Transaction Eurex ETI	10,000	4,500	-	-	-	-	-	-	-
Eurex GUI-Channel	1	40	50	60	R	100	R	110	-	-
	3	110	140	170	R	300	R	340	-	
	10	380	480	600	R	1,000	R	1,100	-	
	40	1,500	1,840	2,300	R	4,000	R	4,600	-	
Eurex GU via Internet	n/a	300 (free of charge with a MIC, or 10 Gbit/s connection in Co-Location)								

Tier A1: Metro areas of London, Frankfurt, Paris, Amsterdam and Zurich.

*For more details on the new connectivity pricing see circular 089/2012.

Tier A2: Metro areas of Chicago and New York.

Tier B1: UK, Germany, France, Netherlands, Switzerland

Tier B2: United States

Tier C: Belgium, Luxembourg, Sweden, Ireland, Italy, Austria, Spain

Tier D: Finland, Singapore, Greece, Australia, Hong Kong, Gibraltar

R and other locations: Availability of high-bandwidth MIC (80 Mbit/s, 260 Mbit/s and 760 Mbit/s) and Eurex Trader GUI in other locations on request.

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Information on Eurex website

- For information on Eurex Exchange's new trading architecture visit the Eurex Exchange website at:
www.eurexchange.com > Technology > New Trading Architecture.
- Documents for the new trading architecture and the new interfaces are available in the member section of the Eurex website (A log-in is required to access the documents):
www.eurexchange.com > Members Section > New Trading Architecture.
- Visit our newsroom at www.eurexgroup.com, if you are looking for the latest news on Eurex Group's products and services.

Further information

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