

The logo for MOEX, consisting of the letters 'MOEX' in white on a red rectangular background.

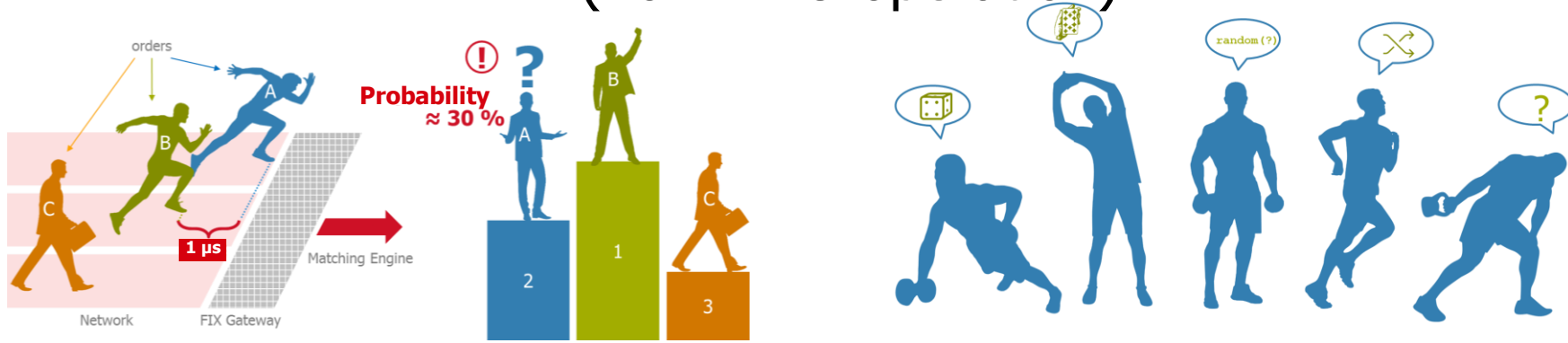
MOSCOW
EXCHANGE

The background features a stylized globe with a network of red dots and lines, and a red candlestick chart on the right side. The text is centered over these graphics.

FIFO MFIX TRADE

Ultra low-latency trading service
for Securities and FX markets

Limitations of standard MFIX Transactional platform (non-FIFO operation)



If **order A** was sent earlier than **order B** by 1 μ s
the probability that the **order A** will be processed by the Trading system earlier than **order B** \approx **70%**
(when tested in equal conditions)

In real market conditions, during peaks
(according to customers feedback) this probability is even lower: \approx **50%**

Several FIX gateways on each market
↓
Latency jitter on parallel inbound paths to Trade Engine

Less predictable transactions processing order and latency
on higher market activity

HFT and Low-latency traders invest significant resources to reduce the reaction time to market events,
but can not be sure that the order sent earlier will be processed by the Trading system earlier than the one sent later.

- Currently MOEX network infrastructure is shared by all the MOEX Trading systems, market data and auxiliary services. Additional latencies may occur due to traffic interference.
- Market members have to use multiple User IDs to send trading orders to multiple gateways simultaneously.

MFIX Transactional platform has reached its' technological limit
in ensuring predictability of transactions processing order.

New service - FIFO MFIX Trade: **Key Benefits**



The fastest trading interface
for MOEX Securities and FX markets



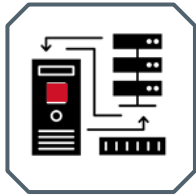
Reduced Latency and Jitter
to meet latency sensitive clients expectations



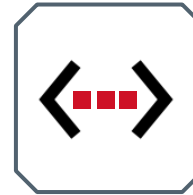
Increased system predictability
to provide technological Fair Play



99,5 % FIRST IN – FIRST OUT
probability in messages ordering on gateway



New gateway core architecture
tuned for higher throughput



New dedicated network infrastructure exclusively for FIFO MFIX traffic

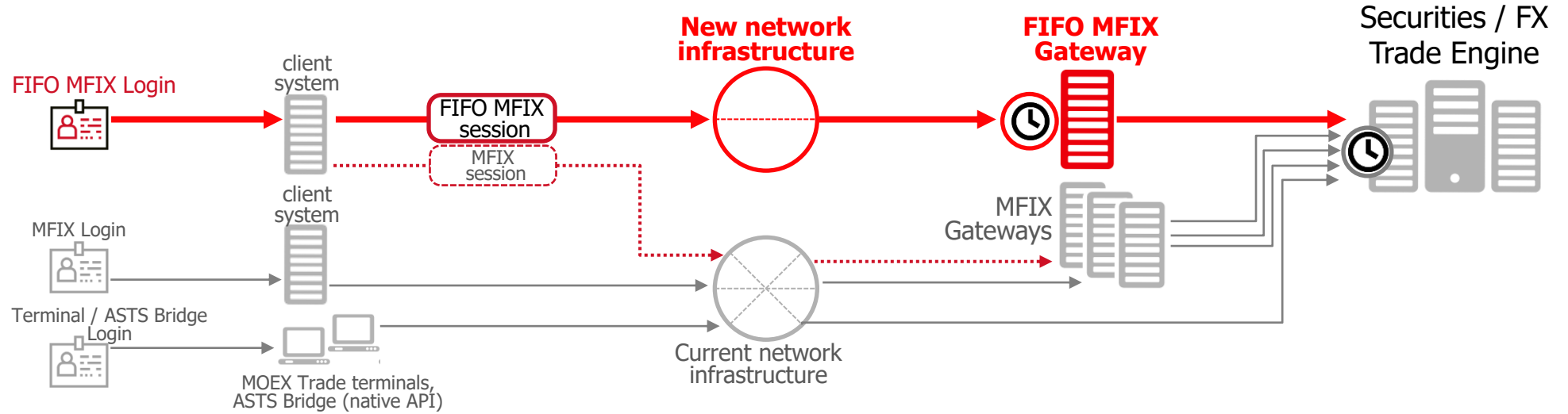


All current trading services
including MFIX Trade
remain available for clients.



FIFO MFIX Trade launch **does not affect clients using MOEX Terminals and Native API.**

FIFO MFX Trade: Service Overview



- **The new FIFO MFX Logins are required** to use the service. These logins can also connect to standard MFX Transactional in case FIFO MFX Trade is temporary unavailable.
- The new **dedicated network infrastructure** was implemented for FIFO MFX Trade. This shorter network path **serves Securities and FX FIFO MFX GWs transactional traffic exclusively** to eliminate additional latencies caused by market data and auxiliary services traffic. **The new links available exclusively in MOEX Co-location are required to connect to FIFO MFX Gateways.**



FIFO MFX Trade

- FIFO MFX Logins and network links are **priced separately**.

- There will be **no limitations on number of Logins** connecting through one link.
- **Both L2 and L3 links** available.

WHY **FIFO MFIX Trade** ?



The major upgrade of MOEX infrastructure performed in 2016-2018 and global progress in high frequency trading enabled **MOEX Co-location clients to compete in fractions of μ s in their reaction times.**



High competition requires **predictable system operation to ensure fair play principles in delivering orders to the Trade Engine queue.**



Standard MFIX Trade platform has reached its limit in servicing customers technological competition on a microsecond fractions level

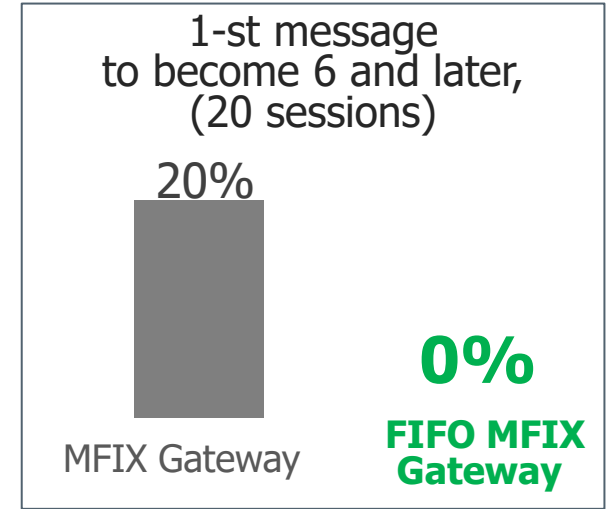
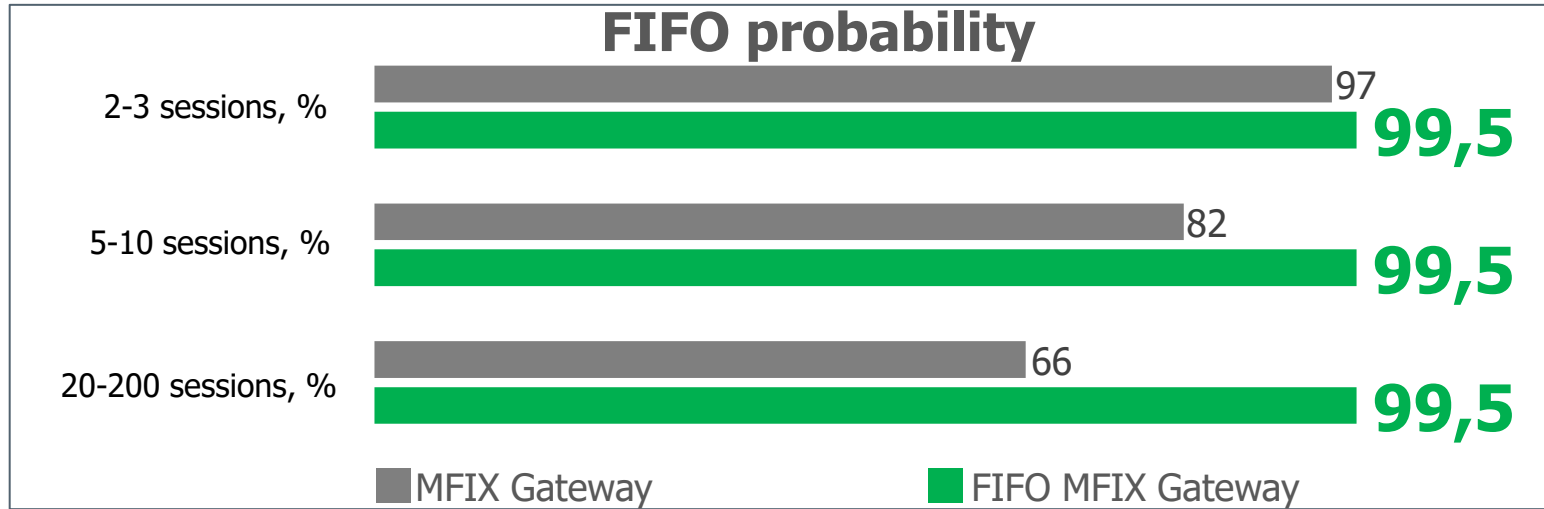


Moving towards First In First Out (FIFO) principles meets customers' expectations and complies industry Best Practices



FIFO MFIX Trade is designed to reduce latency and jitter, and to increase system operation predictability while simplifying its use.

Comparing MFIX Gateway and **FIFO MFIX Gateway** on Production configuration (*2*Intel® Xeon® Gold 6146 CPU + RHEL 7.6*)

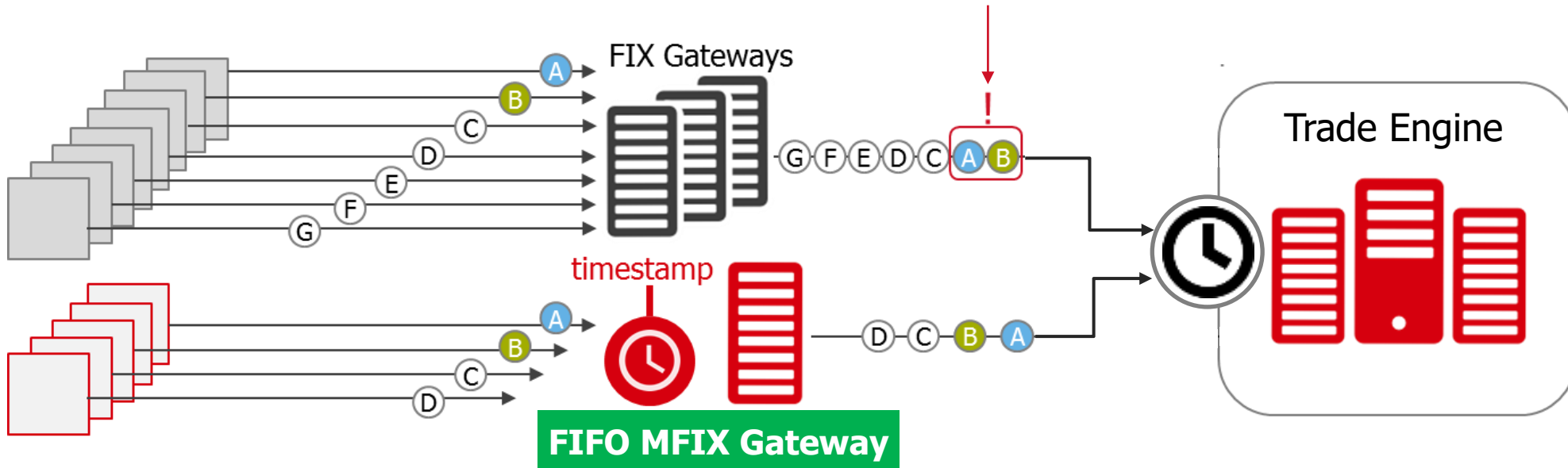


✓ **FIFO probability exceeds 99%** for any number of competing sessions.

Timestamping

In MFIX Transactional architecture timestamps are assigned at the Trade Engine entry only

→ there is a possibility that order A (that reached FIX Gateway earlier than B) will be processed by Trade Engine later then order B.

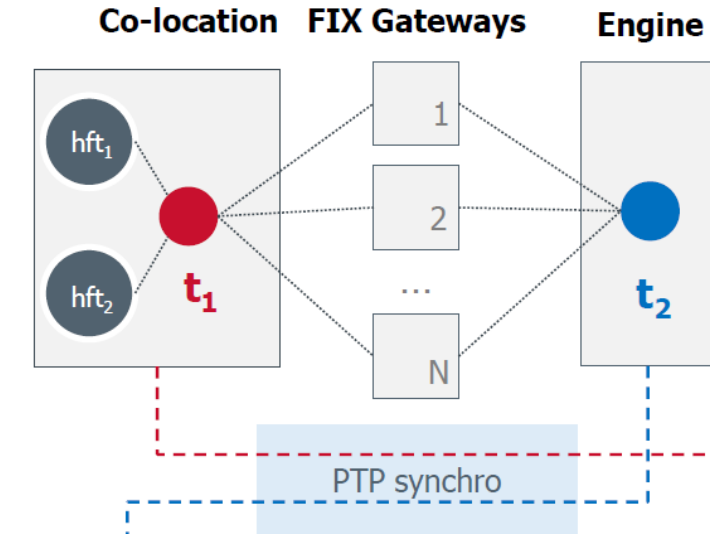


- ✓ FIFO MFIX Gateway design minimizes this probability **as hardware timestamps are assigned at the FIFO MFIX Gateway entry and messages are sent to the Trade Engine in strict ascending order of these timestamps.**
- ✓ **The order of incoming** (to the Trade Engine) **messages** by hardware timestamps assigned by FIFO MFIX Gateway **is 100% consistent with Corvil network monitoring system data.**
- ✓ Some ordering uncertainty may still remain on networking level;
- ✓ *In rare high load situations* order sent via MFIX Gateway may reach Trade Engine earlier than one sent via FIFO MFIX Gateway.

TimeStamps Analytics product | New version

What's New:

1. Contains data on all orders. Absolute value of time in the Co-location (COLOTIME) is specified.
2. Additional data on orders rejected by the Trading System is provided.
3. **Orders via FIFO MFIX scheme added**



Rejected orders

ORDERID	TYPE	STATUS	DSTIP	COLOTIME
200206851	R	✓ E	91.203.0.1	100556538934.123
200206851	R	✗ RJ	91.203.0.2	100726863645.456
200206851	R	✗ RJ	91.203.0.3	100726863645.567

TYPE – P:put, R:replace, C:cancel

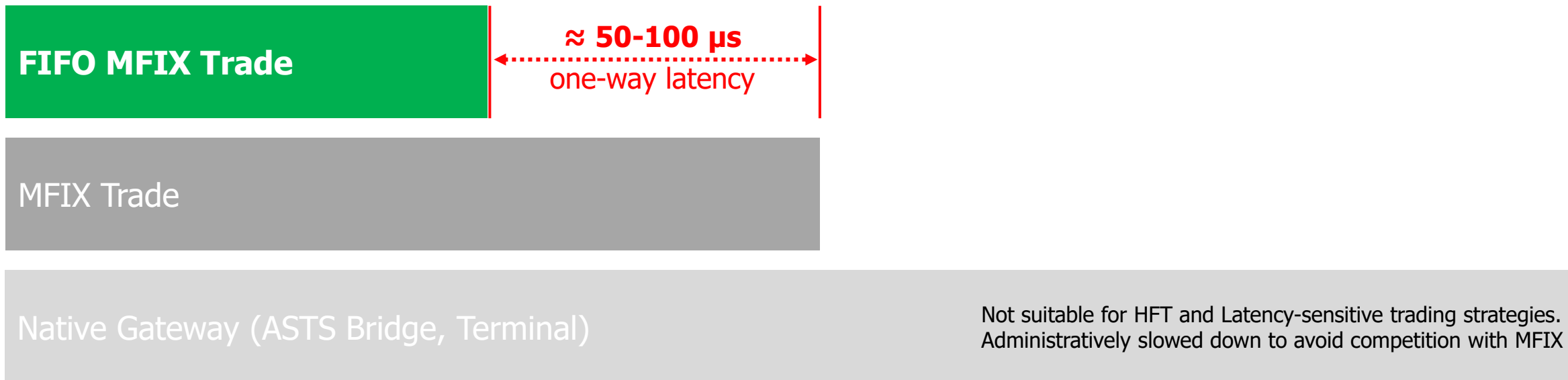
Sample Data

TIME	TICKER	ACTION	ORDERNO	VOLUME	DIR	PRICE	TRADENO	DSTIP	COLOTIME
100000023008	USD000UTSTOM	1	20075519160	200000	S	69.5625			
100000023704	USD000000TOD	1	20075519161	50000	S	69.545		91.203.252.29	100000023518.251
100000024338	USD000UTSTOM	1	20075519162	200000	S	69.5725			

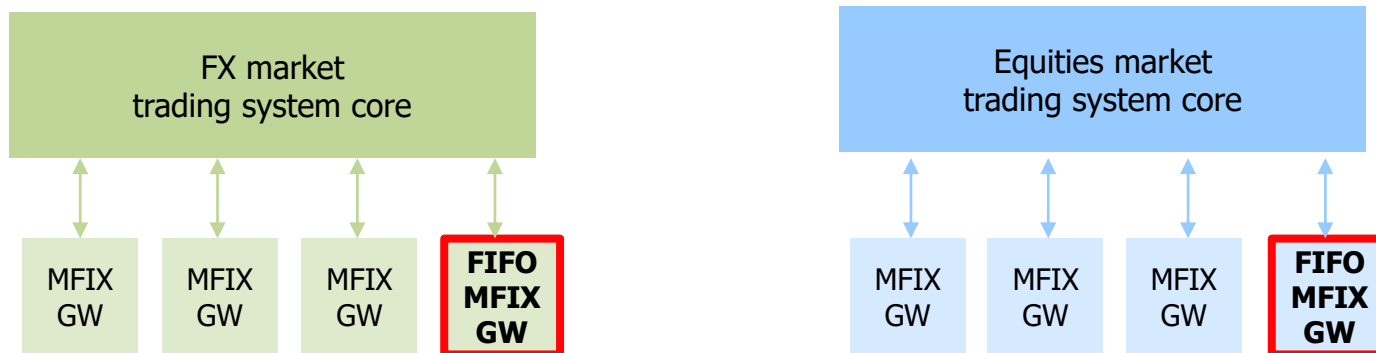
TIME – time of the Trading System
COLOTIME – time in the Co-location
DSTIP – Gateway IP address

Service Latency

- **FIFO MFIX Trade** is designed **to be the fastest order entry interface** on MOEX Securities and FX markets. It's recommended for HFT and Low-latency traders whose reaction time is measured by fractions of μs .
- Current MFIX Trade service will remain available for clients but currently we do not expect it to be competitive against FIFO MFIX Trade excluding some rare, hardly predictable high load situations.



Notes services architecture



- 3 Gateways serve each market in MFIX Transactional scheme. MFIX Gateways are statistically identical but transaction processing times may vary due to load differences.
- MFIX Gateways remain available for clients and is recommended as backup in case FIFO MFIX Gateway is temporary unavailable.
- FIFO MFIX Gateway throughput greatly exceeds MFIX Gateway. It is sufficient to use **only one instance of FIFO MFIX Gateway on each market** to ensure the maximum possible FIFO probability.
- Currently there are no plans to organize hot backup of FIFO MFIX Gateways. Only cold backup will be provided

FIFO MFIX Trade and MFIX Transactional client interfaces are both based on FIX 4.4. and are very similar.

There only difference at the moment is the following:

FIFO MFIX Trade delivers optional field FIFOViolationReason in the Execution Report, Order Cancel Reject (35=9) and Order Mass Cancel Report (35=r) to indicate that incoming message was processed out of FIFO queue and delayed:

This change was released on 14 December, 2020.

- Interface description is available at:
http://ftp.moex.com/pub/FIX/ASTS/docs/public_fix44_interface_in_eng_v4_6.pdf

▪ .

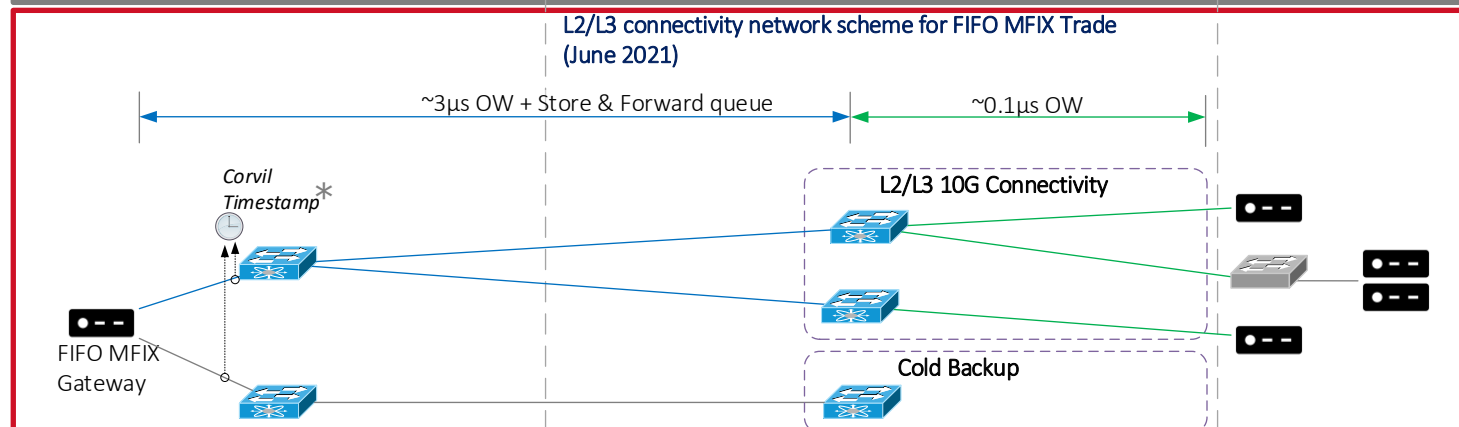
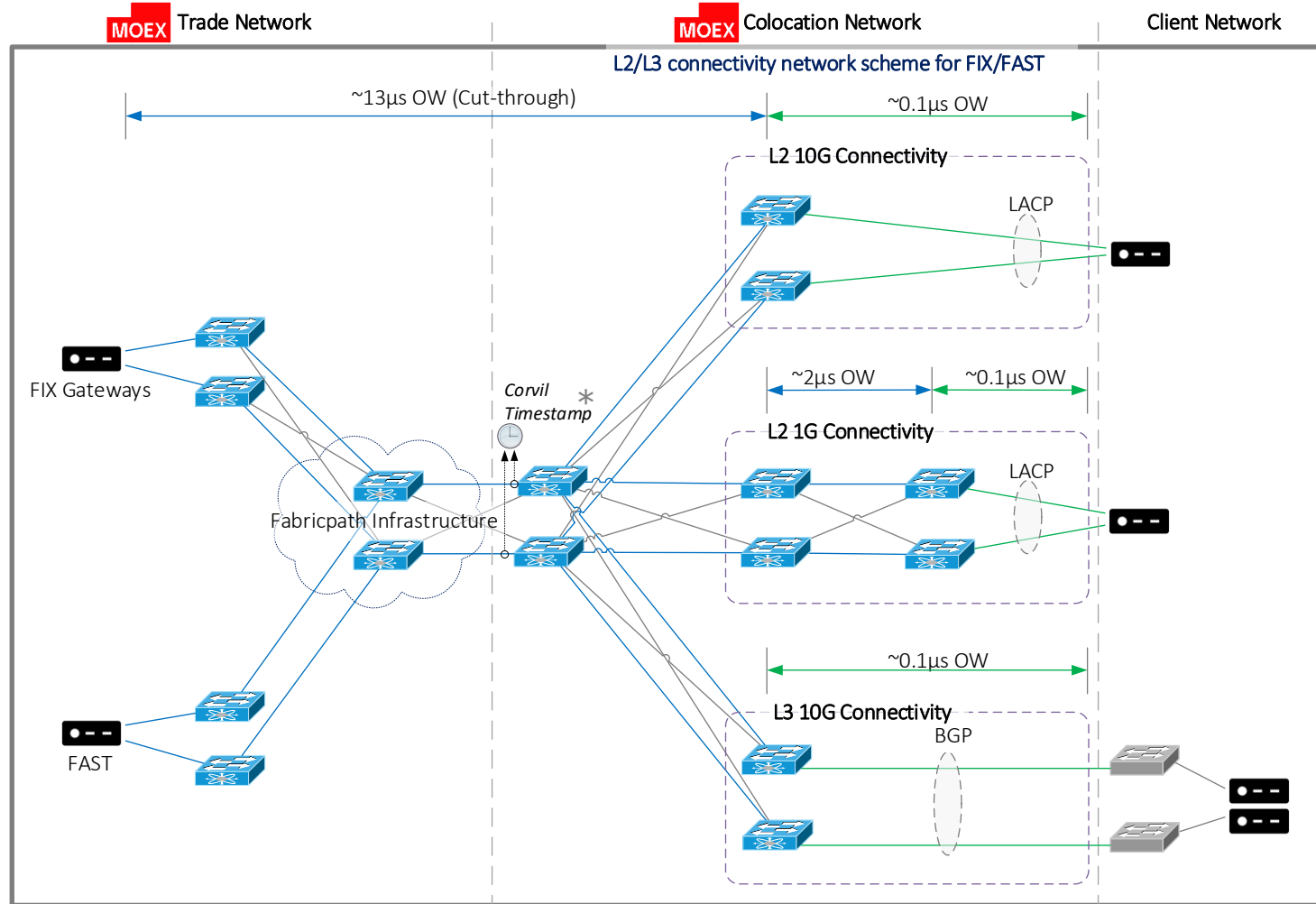
NETWORK INFRASTRUCTURE

Standard MFIX and FAST services network infrastructure

Dedicated FIFO MFIX Trade network infrastructure (June 2021)

*Corvil system collects data of FIX gateways and FIFO FIX gateways with timestamps provided by different switches. System clock values on these switches, FX and Securities trade engines and different FIX gateways (including FIFO GW) may vary within PTP protocol precision range.

**Client connection mirroring service is not provided for FIFO MFIX Trade.



How FIFO MFIX Trade may affect HFT and Low-latency Traders

- **Duplicating messages over multiple MFIX Transactional sessions is widely used on MOEX Securities and FX markets.** Customers tend to use multiple logins to improve their competitiveness as tuning algorithms to reduce reaction times does not lead to guaranteed win: there is no guarantee that order which was sent earlier will be processed by Trade Engine earlier.
 - **FIFO MFIX Trade increases FIFO probability up to 99,5%**
 - **There is no sense in duplicating messages** sent to FIFO MFIX Gateway.
 - MFIX GW and FIFO MFIX GW do not send duplicated Order Cancel or Replace messages to the Trade Engine.
- According to clients feedback, **implementing FIFO principles significantly improved the predictability of algorithms training results, even for not the fastest trading strategies.**
- FIFO MFIX Gateway launch may potentially lead to clients competition on networking level including low-level ethernet/tcp tricks.

FIFO MFIX Trade is up and running.

FIFO MFIX Trade on MOEX web site: <https://www.moex.com/a7367>

Interface description: <http://ftp.moex.com/pub/FIX/ASTS/docs/>

FAQ on FIFO MFIX Trade, TimeStamps, PTP: <https://fs.moex.com/files/22057>

Feel free to contact us in case of any questions: ITsales@moex.com .

Tariffs

	One-off charge	Monthly charge
FIFO MFIX Login (technical access)	30 000 RUB (~400 USD)	30 000 RUB (~400 USD)
10G link to FIFO MFIX Trade in co-lo	100 000 RUB 1 450 USD 1 200 EUR <i>subject to 20% VAT</i>	100 000 RUB 1 450 USD 1 200 EUR <i>subject to 20% VAT</i>