

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

MOSCOW
EXCHANGE

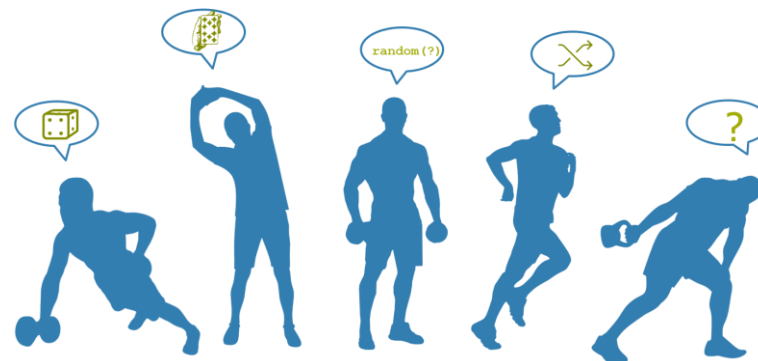
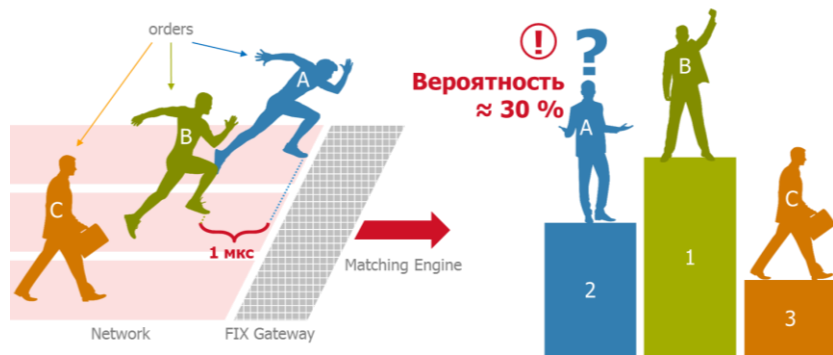
The background features a stylized globe with a network of red dots and lines, and a red candlestick chart on the right side. The text is centered over these graphics.

FIFO TWIME ASTS

Ultra low-latency trading service
for Securities and FX markets

A solid red bar at the bottom of the page, with a stepped, staircase-like profile.

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't 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 TWIME ASTS: Key Benefits



The fastest trading interface
for MOEX Securities and FX markets
based on FIX **S**imple **B**inary **E**ncoding



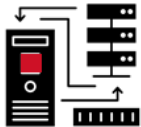
Reduced Latency and Jitter
to meet latency sensitive clients expectations



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 TWIME traffic

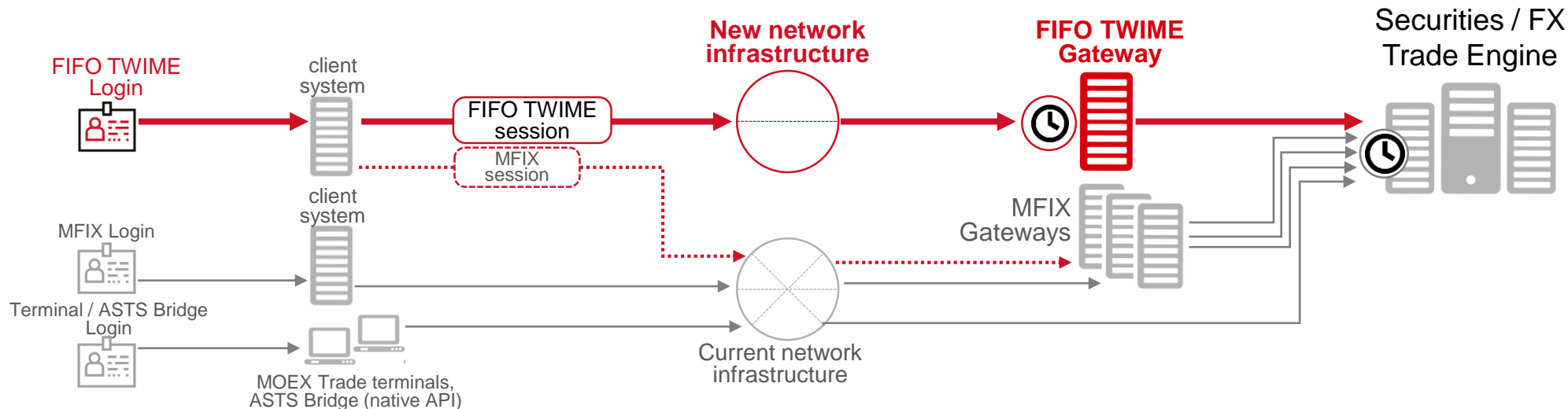
- Terminal
- Native API
- FIX
- FIFO TWIME ASTS

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

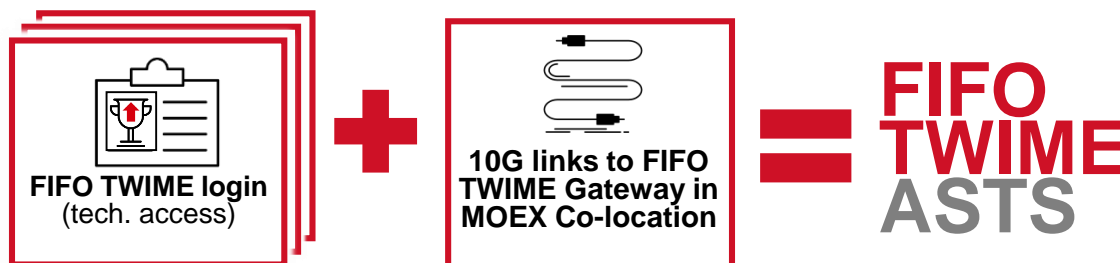


FIFO TWIME launch **does not affect**
clients using **MOEX Terminals and**
Native API.

FIFO TWIME ASTS: Service Overview



- **The new FIFO TWIME Logins are required to use the service.** These logins can also connect to standard FIX Gateway in case FIFO TWIME ASTS is temporary unavailable.
- **The new dedicated network infrastructure was implemented for FIFO TWIME ASTS.** This shorter network path serves **Securities and FX FIFO TWIME 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 TWIME Gateways.**



- FIFO TWIME 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 TWIME ASTS?



The major upgrade of MOEX infrastructure performed in 2018-2022 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.**



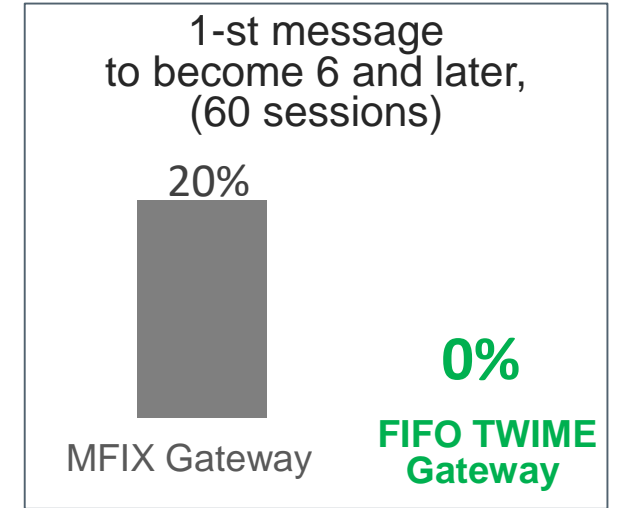
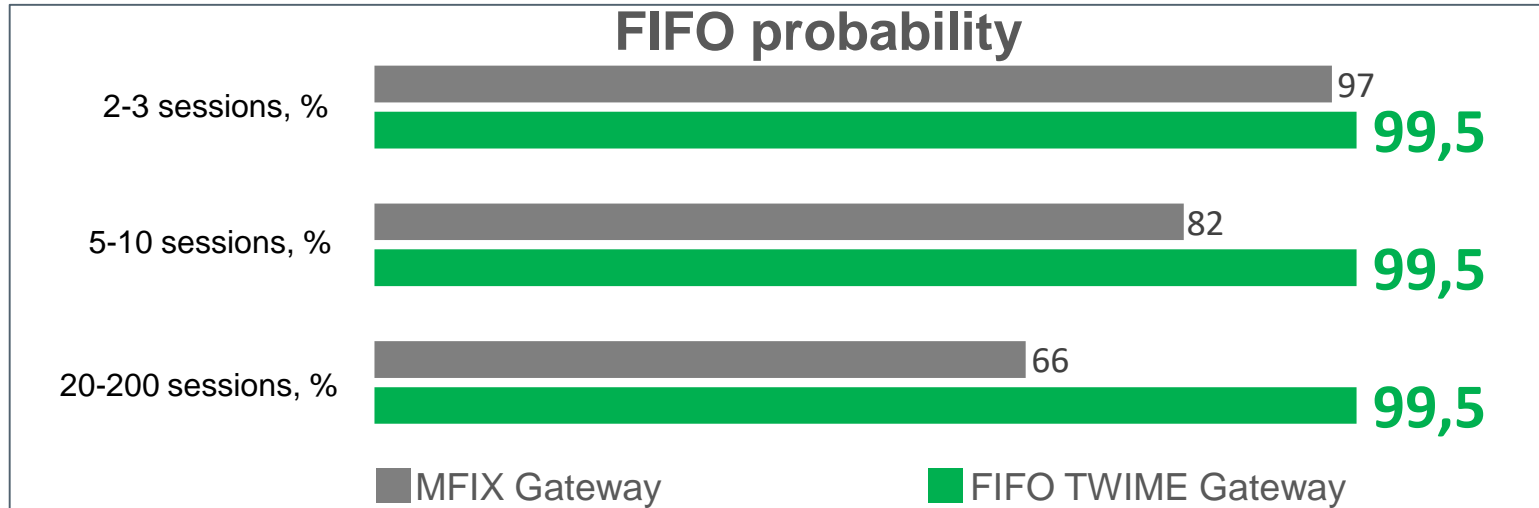
Standard MFIX Transactional platform has reached its limit in servicing customers technological competition on a microsecond fractions level.



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



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

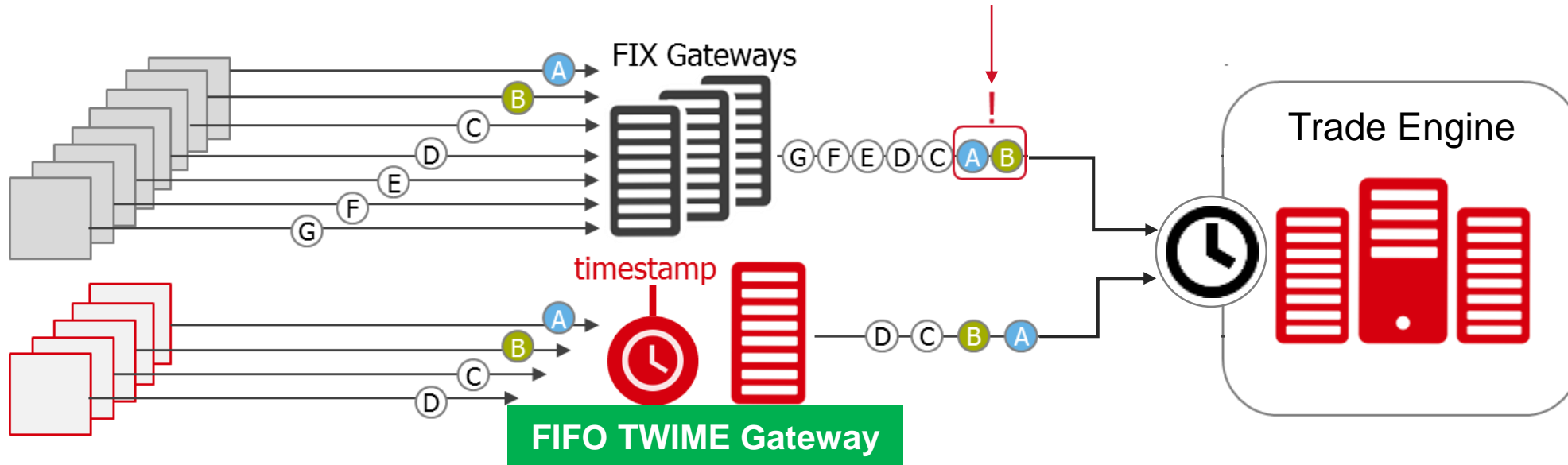


✓ **FIFO probability exceeds 99%** for any number of competing sessions.

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



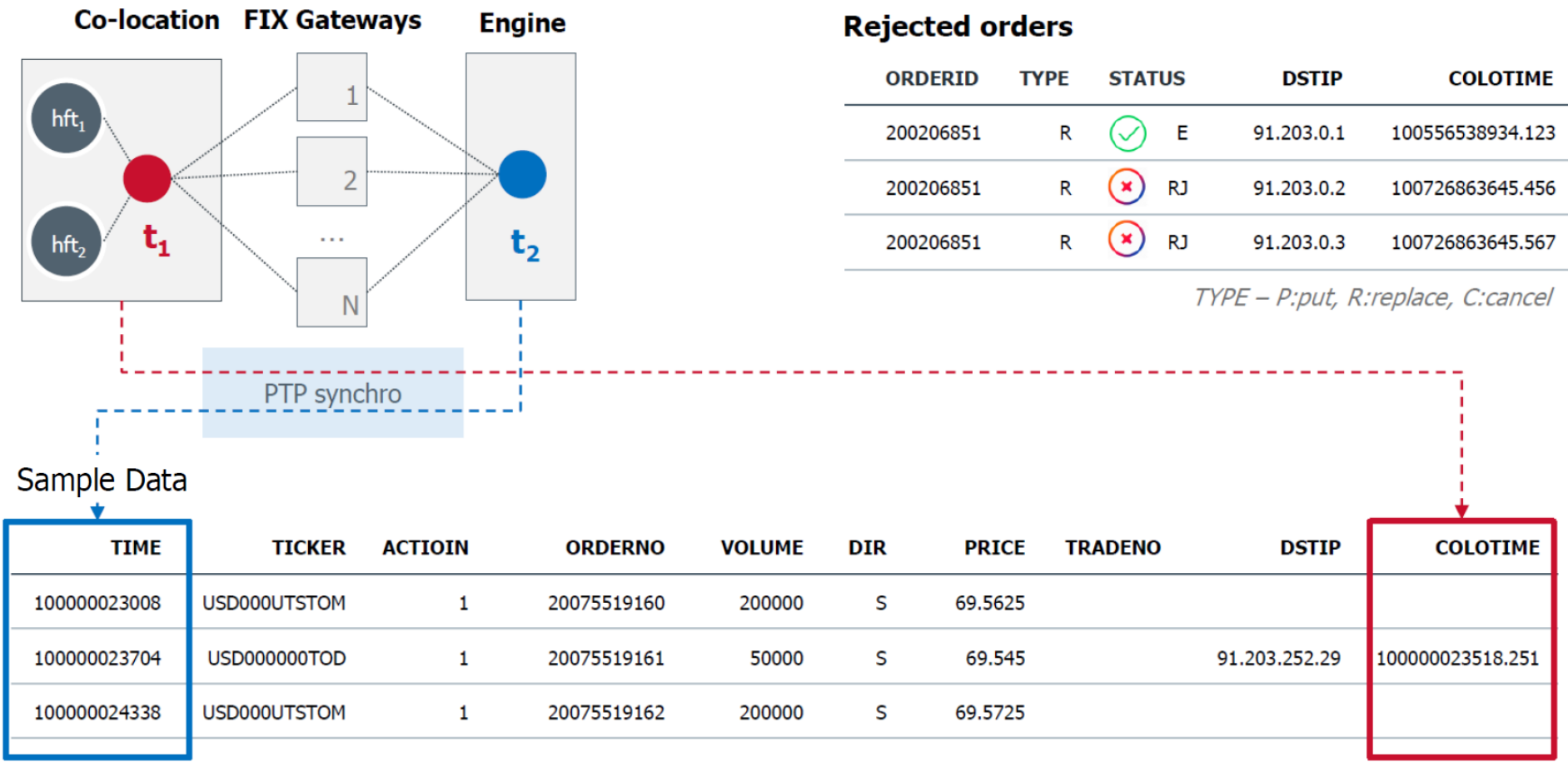
✓ FIFO TWIME Gateway design minimizes this probability as **hardware timestamps are assigned at the FIFO TWIME Gateway entry and messages are sent to the Trade Engine in strict ascending order of these timestamps.**

- ✓ **The order of incoming** (to the Trade Engine) messages by hardware timestamps assigned by FIFO TWIME 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 TWIME 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 TWIME scheme added



Rejected orders

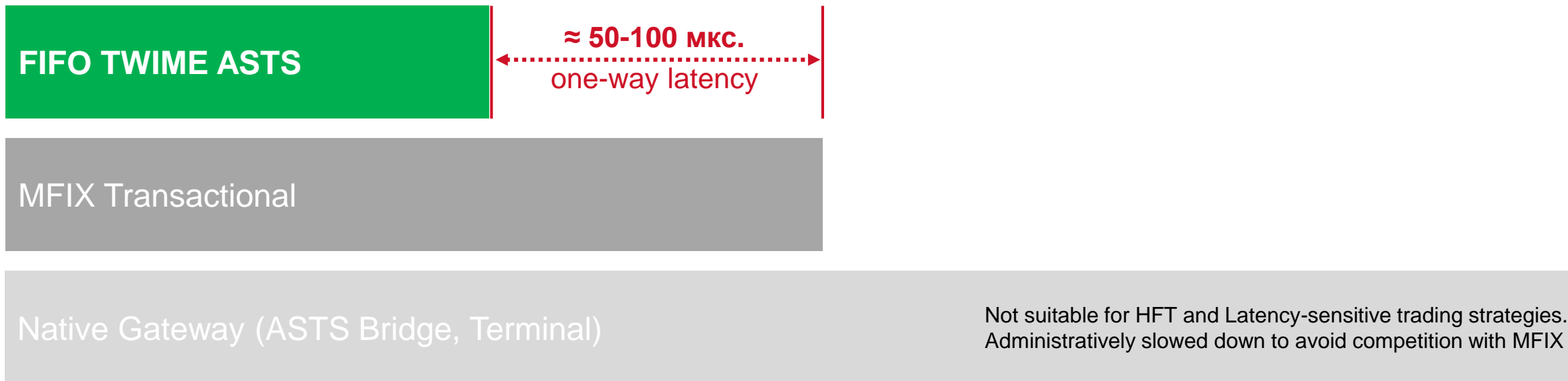
ORDERID	TYPE	STATUS	DSTIP	COLOTIME
200206851	R	✓ E	91.203.0.1	100556538934.123
200206851	R	✗ RJ	91.203.0.2	100726863645.456
200206851	R	✗ RJ	91.203.0.3	100726863645.567

TYPE – P:put, R:replace, C:cancel

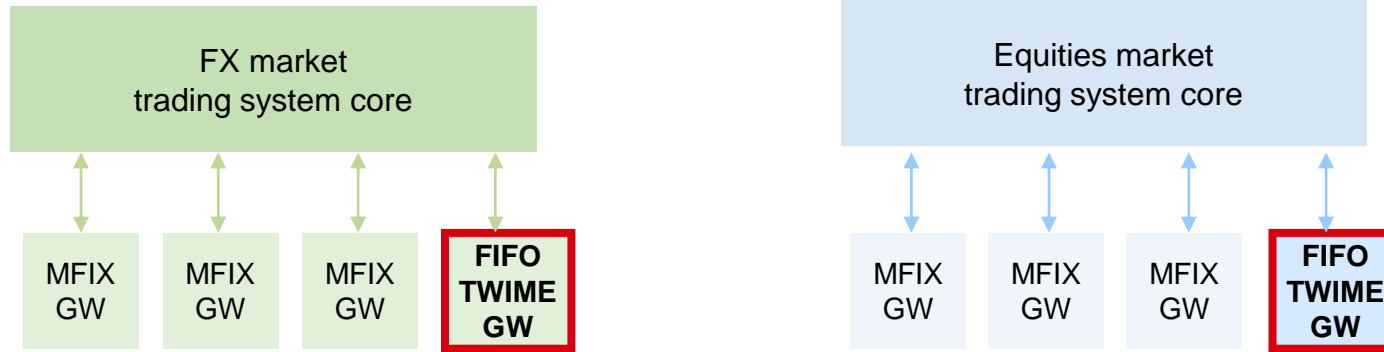
TIME – time of the Trading System
 COLOTIME – time in the Co-location
 DSTIP – Gateway IP address

Service Latency

- **FIFO TWIME ASTS** 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 μ s..
- Current MFIX Transactional service will remain available for clients, but currently we do not expect it to be competitive against FIFO TWIME ASTS 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 TWIME Gateway is temporary unavailable.
- FIFO TWIME Gateway throughput greatly exceeds MFIX Gateway. It is sufficient to use **only one instance of FIFO TWIME Gateway on each market** to ensure the maximum possible FIFO probability..
- Currently there are no plans to organize hot backup of FIFO TWIME Gateways. Only cold backup will be provided.
- Interface description is available at:
[ftp.moex.com - /pub/TWIME/ASTS/docs/](ftp://ftp.moex.com/pub/TWIME/ASTS/docs/)

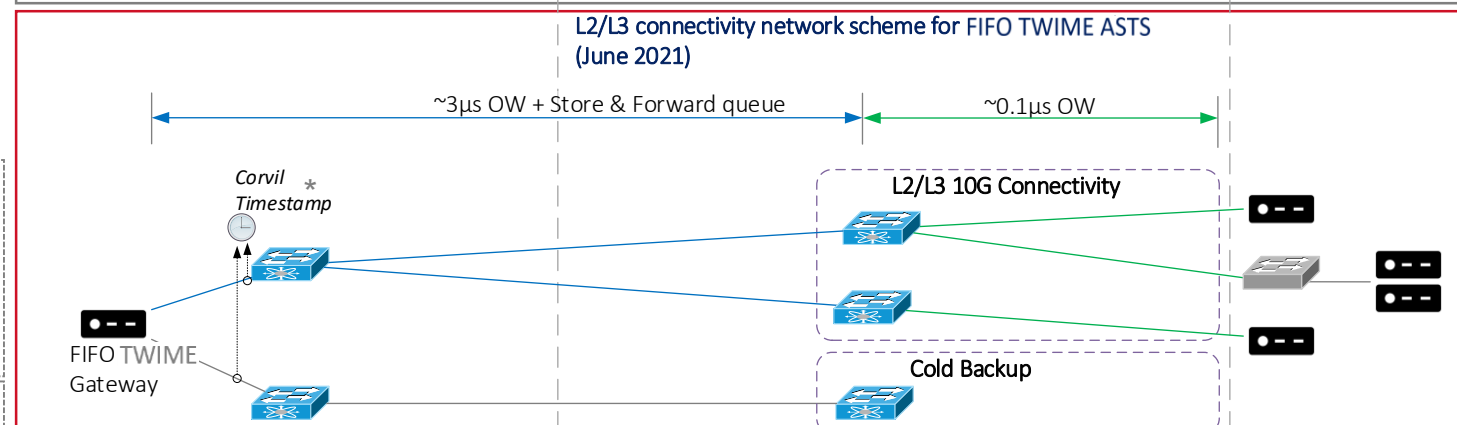
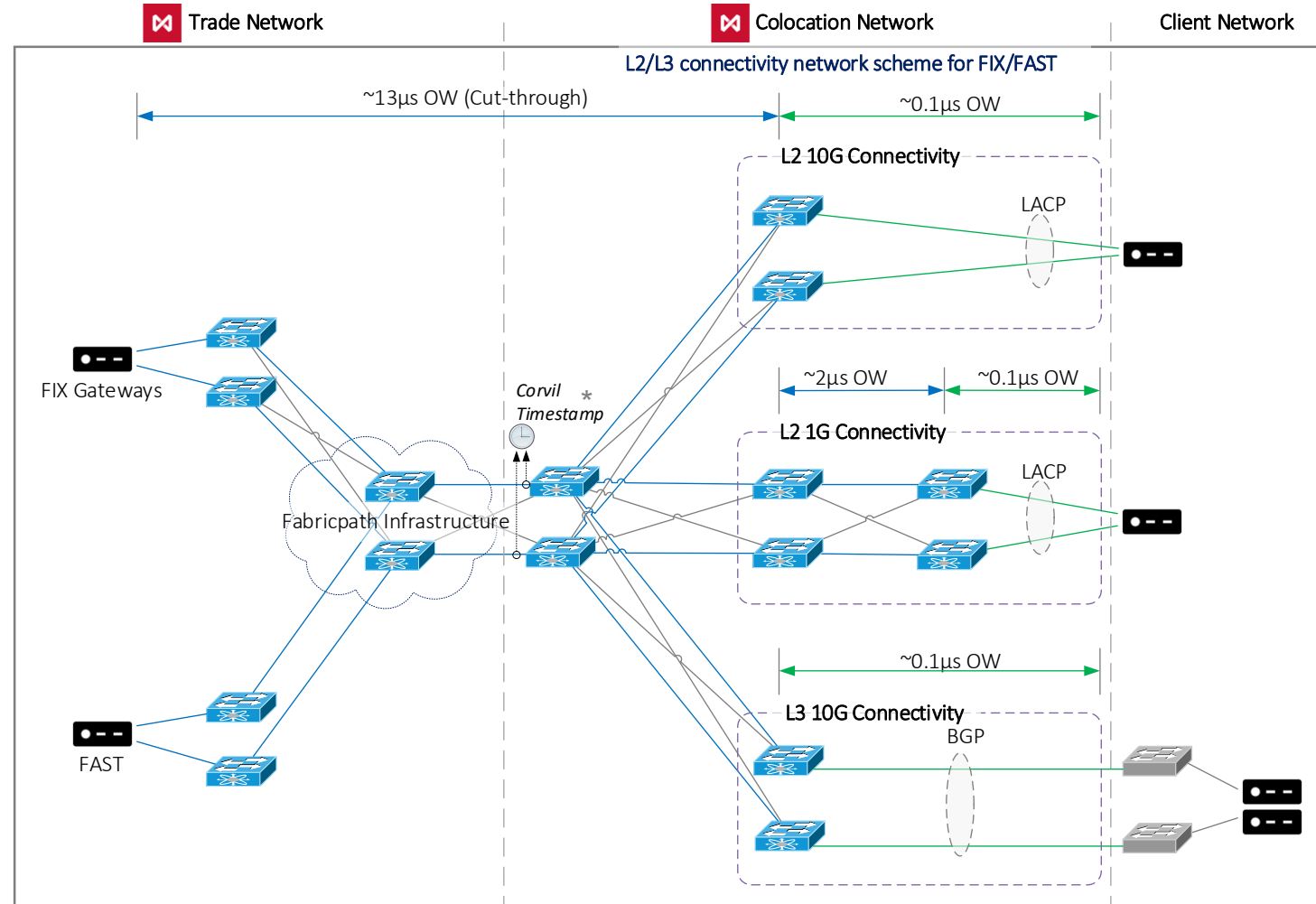
NETWORK INFRASTRUCTURE

Standard MFIX and FAST services network infrastructure

Dedicated FIFO TWIME Trade network infrastructure (June 2021)

* Corvil system collects data of FIX gateways and FIFO TWIME 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 TWIME ASTS.



How FIFO TWIME ASTS 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 TWIME ASTS:
 - **increases FIFO probability up to 99,5%.**
 - **There is no sense in duplicating messages** sent to FIFO TWIME Gateway.
 - MFIX GW and FIFO TWIME 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 TWIME Gateway launch may potentially lead to clients competition on networking level including low level ethernet/ tcp tricks.

FIFO TWIME ASTS is up and running.

FIFO TWIME ASTS on MOEX web site: <https://www.moex.com/s3183>

Interface description: <ftp.moex.com - /pub/TWIME/ASTS/docs/>

FAQ on FIFO TWIME ASTS, TimeStamps , PTP: <https://fs.moex.com/files/22056>

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

Tariffs

	One-off charge	Monthly charge
FIFO TWIME Login (technical access)	30 000 ₺	30 000 ₺
10G link to FIFO TWIME in co-lo	100 000 ₺ subject to 20% VAT	100 000 ₺ subject to 20% VAT