

## Millennium Exchange™

Resilient, scalable and adaptive trading platform

LSEG Technology, the power behind many of the world's financial markets, provides robust, scalable, and high-performance broker, exchange, market data, risk management, surveillance, clearing and depository products globally. LSEG Technology delivers key platform and operational efficiencies to over 50 financial market infrastructure and financial services firms that include London Stock Exchange Group, HKEX, Johannesburg Stock Exchange Singapore Exchange, London Metal Exchange, Aequitas NEO, NCDEX, TP-ICAP and key market participants worldwide.

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## Resilient, scalable and adaptive trading platform

Millennium Exchange is a multi-asset, multi-market, trading platform designed for resiliency, high performance and ultra-low latency. It is proven in the most demanding and innovative trading venues across the financial markets infrastructure space, providing clients the competitive advantage needed to succeed in the demanding and changing marketplaces they operate within.

### Key Facts

#### Best-in-class technology and reliability

The hallmark of Millennium Exchange is its robust fault tolerance and disaster recovery capability that has recorded unparalleled uptime across its implementations. The resilient platform is designed to avoid single points of failure and uses parallel, concurrent processes to ensure zero transaction loss during all types of failover events.

#### Feature rich trading platform

Out-of-the box trading solution for equity, fixed-income and derivative instruments on a single robust platform that meets standard trading requirements off-the shelf, leading to reduced time-to-market and lower implementation risk.

#### Leveraged on by 20+ markets around the globe

Millennium Exchange is a solid technology foundation on which a diverse set of 20+ clients rely to provide trusted and stable markets to their members, with a history of delivering against requirements in some of the most sophisticated regulatory regimes in the world.

#### Unparalleled uptime record

Track record for resiliency with 99.999% uptime across tier-1 markets.

#### High performance and throughput

Benchmark latency of <30 microseconds and throughputs of 100,000 orders per second/partition (scalable up to a million orders per second) on off-the shelf commodity hardware.

#### Deployable on cloud

Leveraging the latest technology stack to reduce total-cost-of-ownership (TCO) and time-to-market.

#### Scalable platform

Scalable both horizontally and vertically to quickly respond to increased transaction volumes without software changes, solely by means of application configuration.

#### Market-driven product roadmap

A product-based implementation approach follows an industry-validated functional and technical roadmap.

With a broad spectrum of global clients, Millennium Exchange forms part of the integrated Millennium Trading™ product suite that includes the Millennium SOR™, Millennium Surveillance™ and Millennium Market Data™ offerings. Combined, the suite provides a fully integrated, reliable and cost-effective solution that meets a global set of trade execution requirements.

### Functional Highlights

#### Multi-asset and market support

Extensive support for a multitude of asset classes including equity, fixed income, currencies, commodities and their derivatives. Capability to roll-out multiple market structures within the confines of a single venue.

#### Wide range of matching algorithms

Easily configurable matching logic from existing methodologies such as order types and time qualifiers to reflect the liquidity/volatility profile of the market or a specific group of instruments.

#### Market maker support

Market maker protection and monitoring combined with highly deterministic latency profile to support high frequency quoting.

#### Implied in, out and across orders

For derivatives strategies, increase liquidity by deriving liquidity/orders within strategy order books and/or leg order books based on resting orders.

#### Comprehensive set of pre-trade risk filters

Enhance market integrity with trading safeguards such as fat finger checks as well as exposure based pre-trade risk checks to ensure orderly trading.

#### Low latency binary gateways for HFTs

End-to-end gateway latency of <30 microseconds along with highly deterministic latency profile.

#### Market data and integrated index calculator

For better monetization of your data, leverage a variety of real-time index computations and enriched market data solutions.

#### RFQs and trade negotiations

Tools to facilitate liquidity formation/discovery without the risk of information leakage.

#### Integrated market operations

Intuitive browser based business operation UI for efficient market control, supervision and reference data management.

Millennium Exchange is a resilient platform with an extensive and rich range of out-of-the-box functionality and a proven track-record of solid up-time and operational availability.

### Key Business Benefits

#### Easy deployment and configuration

An easy to configure system, facilitating unique market structure requirements. The core system provides readily deployable, out-of-the-box functionality on which enhancements can be quickly brought to market.

#### Market Ready

Equipped with core exchange operational requirements (MIFID-II/Dodd-Frank) that are applicable to a variety of tier-1 market models ensuring minimal conformance effort.

#### Ease of integration

Able to on-board trading participants quickly via an industry standard gateway framework that promotes efficient connectivity, interoperability and automation. More than 100 ISVs have already established connectivity to Millennium Exchange.

#### Low total cost of ownership

Optimise infrastructure investment by deploying the system on either physical hardware or directly on the Cloud. The system is fully scalable both horizontally and vertically, allowing for rationalised infrastructure investment to match the scale of the operation as the business grows, while preventing unnecessary infrastructure tie-in.

#### Fast time to market

Technology and feature enhancements are delivered through frequent upgrades and a managed roadmap that considers time-to-market, emerging technology enhancements and the cost of ownership.

## Key Components

Millennium Exchange is a fast, resilient and functionally complete trading system that supports multiple markets and assets on a single platform.

Millennium Exchange leverages a distributed process architecture, where logical units of a large system are broken down into smaller manageable processes, deployed on off-the-shelf commodity servers and high-bandwidth networks.

Individually designed, decoupled and modular components are at the root of the clean software design of Millennium Exchange. This architecture is key to remaining cost-effective and competitive in today's fast evolving marketplace.

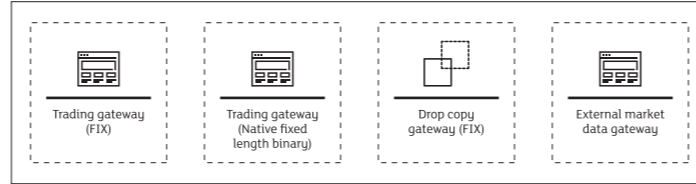
## Millennium Exchange

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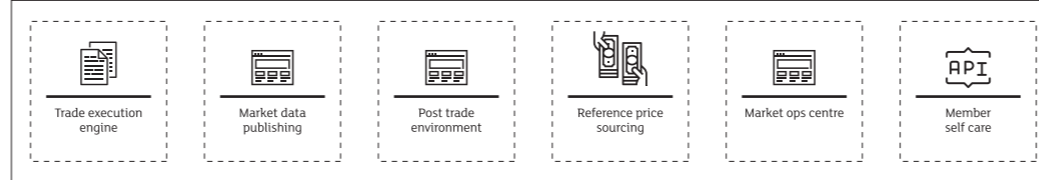
### Integrated markets



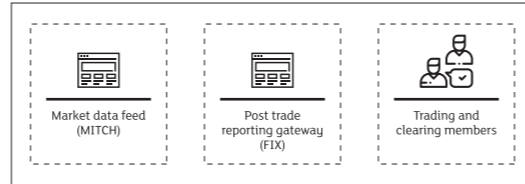
### Inbound gateways



### Trading components



### Outbound gateways



## Technical Overview

### Leveraging a proven technology platform

Millennium Exchange is built on the Millennium Advanced Platform™, enabling high performance real-time processing together with the superior resiliency that characterizes all our products from order routing to post trade across our client base.

### Extensive performance and scalability

Operating on a low cost Linux platform and running on low maintenance commodity hardware infrastructure or directly on the Cloud, Millennium Exchange is cost-effective to test, deploy, maintain and upgrade.

Production benchmark latency of <30 microseconds and throughputs of 100,000 orders per second/partition (scalable up to a million orders per second) on off-the shelf commodity hardware.

### Ensuring resiliency and quick recovery

This multi-component system is managed by LSEG Technology's proprietary process management and life-support system, SysGuard. This approach eliminates single points of failure, ensuring resiliency and quick recovery to provide an uninterrupted service.

### A feature rich flexible platform

Millennium Exchange also provides functional and operational flexibility through a wide array of parameters and rules. This enables short build to production time with configurable rule-based mapping and data modelling capabilities. The creation of new asset-classes, order-types, matching-logic, etc. can be achieved without changes to underlying code.

All of its core features (e.g. instrument models, extendable messaging protocol, matching rules, reference data validation rules, user hierarchy, permissions) are configurable, without needing to modify the code. This enables many complex changes and additions to be made quickly, without an impact or risk to the rest of the platform.

## Technical Platform

Millennium Exchange is platform and architecture independent, and can be deployed across a varying spectrum of configurations.

- ☒ Physical or Cloud deployment
- ☒ Distributed, message-based
- ☒ Software-based fault tolerance with zero data loss
- ☒ Business rule engine
- ☒ Web-based front ends
- ☒ Database: Postgre SQL or Oracle
- ☒ Operating System: Linux