Millennium Surveillance™

Resilient, scalable and adaptive surveillance 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 surveillance platform

Millennium Surveillance is a multi-asset, multi-market surveillance platform focused on improving the efficiency of market abuse investigations. A high performance platform that is cost-effective to implement, manage and enhance.

The feature rich Millennium Surveillance platform forms part of the integrated Millennium Trading™ product suite that includes the Millennium Exchange ™, Millennium SOR™ 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.

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

Key Facts

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

Python and Scala languages for alert configuration
Includes a comprehensive alert configuration workbench (PATLAB) to build Python and Scala alert algorithms to detect patterns of trading behaviour leveraging already proven models and functions.

Real-time surveillance capability
Real-time alerting and investigation capabilities enable the identification of potential market abuse and manipulation attempts for immediate action to maintain an orderly market.

Leveraging machine learning technologies
Machine learning based anomaly and outlier detection is offered as an add-on module to help calibrate alert parameters. The standard pattern-miner functionality too can be leveraged to mine historical data to discover missed market manipulations and for continuous calibration of alert parameters.

High performance and throughput
Production processing performance of 150,000 messages per second per partition and managing a billion messages per trading day on off-the shelf commodity hardware.

Integrated business analytics
Users can leverage preferred data visualization and analytics tools to augment alert investigation. Create interactive dashboards that combine surveillance data with external complimentary data to provide a complete picture.

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

Functional Highlights

Self-serviceability
User definable alert, reports and dashboards with extensions to external platforms to leverage and extend surveillance features.

Multi-asset and market support
Extensive support for a multitude of asset classes including equity, fixed income, currencies, commodities and their derivatives. Capability to consolidate data from multiple markets/asset classes within the confines of a single instance.

Alert ingestion gateway
Alerts and warning from external systems can be ingested to optimize the alert workflow and management efficiencies.

Interactive dashboards to track market conditions
User configurable interactive dashboards derived via user-preferred data visualization tools with options to drill down to the microsecond granule data points.

Order book and market replay
An intuitive tool to visualize every detailed event that took place in the market in its exact chronological order with full control of the event replay. A popular tool amongst users, the market replay module serves as a key investigation tool for both real-time and post-trade market abuse investigation initiatives. The replay functionality greatly improves alert investigation efficiency, and can be leveraged to explain complex inter-related events, across multiple instruments via a synchronous replay of the events with many options to filter and highlight events of relevance to the investigation.

Market-driven product roadmap
Millennium Surveillance is a product designed for ease of use, automated operational cycles and systematized upgrade methodologies. These principles enable the product to adopt a nimble, functionally rich and technically innovative roadmap that is industry practitioner, client and market led & validated.

Key Business Benefits

Adaptable to changing business needs
Self-Serviceability is the cornerstone of the system. Amidst its rich collection of functionality, our clients on average adjust the alert configurations 2-3 times per week to modify or introduce new alerts into production without needing any assistance. This is an indication of the flexibility offered to the users to change, test and deploy alerts and reports into production without incurring additional costs or dependence on internal IT or vendor.

Meets time-to-market needs
An easy to configure base product includes readily deployable, out-of-the-box functionality on which enhancements can be quickly brought to market. Technology and feature enhancements are delivered through an agile roadmap with input from surveillance practitioners. Its current initiatives focus is on reducing time-to market, cost of ownership and investments into a set of disruptive technologies to enhance efficiency of the surveillance users.

Improved market engagement
Via interactive dashboards and analytics, Millennium Surveillance enhances the engagement quality of the market supervision team with its regulators and market participants alike.

Low total cost of ownership
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.

Best-in-class technology and reliability
The hallmark of Millennium Surveillance 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.

Key Components

Millennium Surveillance is a fast, resilient and functionally complete surveillance system that supports multiple markets/assets on a single platform. Millennium Surveillance 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.
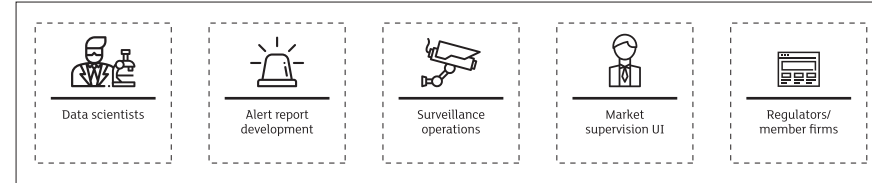
Individually designed, decoupled and modular components are at the root of the clean software design of Millennium Surveillance. This architecture is key to remaining cost-effective and competitive in today's fast evolving marketplace.

The system includes an 'alert development sandbox', that allows users to enhance the alert algorithms using Python and Scala scripting languages along with features to test, debug and deploy modified and new alert algorithms into production without needing vendor or IT assistance.
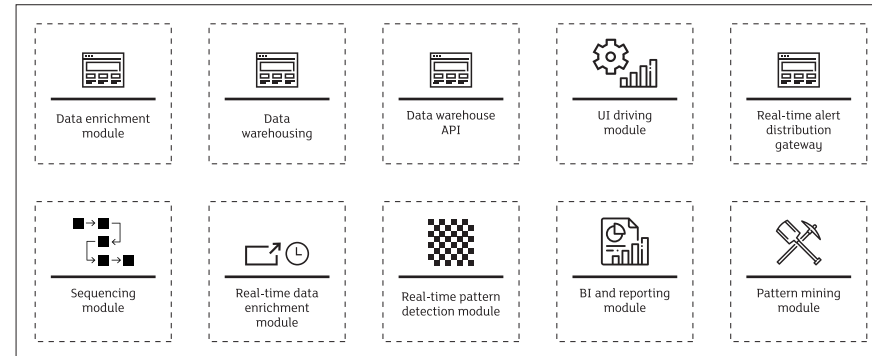
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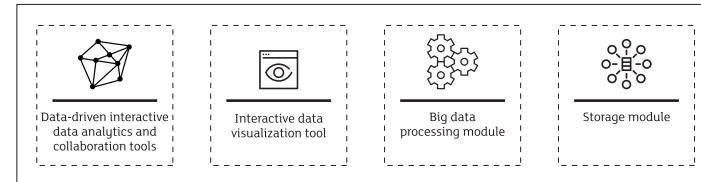Resilient, scalable and adaptive surveillance platform
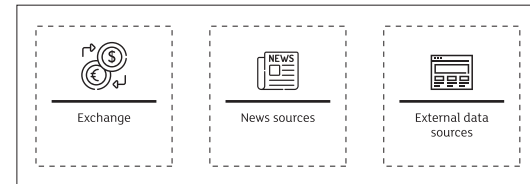
Surveillance user

| Data scientists | Alert report development | Surveillance operations | Market supervision UI | Regulators/ member firms |

Core surveillance modules

| Data enrichment module | Data warehousing | Data warehouse API | UI driving module | Real-time alert distribution gateway |

| Sequencing module | Real-time data enrichment module | Real-time pattern detection module | BI and reporting module | Pattern mining module |

Integrated client systems

| Data-driven interactive data analytics and collaboration tools | Interactive data visualization tool | Big data processing module | Storage module |

Monitored data sources

| Exchange | News sources | External data sources |

Technical Overview

Proven technology platform
Millennium Surveillance is built on top of 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.

High performance and extensive scalability
Operating on a low cost Linux platform and run on low maintenance commodity hardware infrastructure, Millennium Surveillance is cost-effective to test, deploy, maintain and upgrade.

Complimented by proven technologies, the system provides a superior cluster computing platform that supports acyclic data flow and in-memory computing for feature engineering and actionable insights.

Leveraging big data technologies
Integrate Python libraries and statistical packages such as R, MATLAB and Scikit-learn for deep learning. These packages or software solutions leverage proven techniques for clustering, classification, forecasting, finite state machines, optimization, statistical analysis etc. that can leapfrog the surveillance capability, detection accuracy and confidence.

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
Functional and operational features of Millennium Surveillance can be enhanced through a wide array of parameters and rules. This enables a very short build to production time with configurable rule based mapping and data modelling capabilities.

Integration to external machine learning platform
Millennium Surveillance also includes a machine learning toolkit (an add-on module) with a set of outlier detection algorithms. These algorithms can be leveraged to initiate the use of machine learning to enhance market supervision and monitoring functions.

An intuitive web-based UI
Millennium Surveillance offers a web-based and a thin-client user interface. It leverages a micro-services architecture and provides options to integrate additional user-built analytics, dashboards and reports promoting user-led enhancements to the surveillance toolkit.

Technical Platform

Millennium Surveillance can be deployed across a varying spectrum of configurations

- Distributed, message-based
- Software-based fault tolerance with zero data loss
- Business rule engine
- Web-based front ends
- Database: Oracle
- Operating System: Linux