



it's about time

White Paper

The 21st Century Time-series Database

Making real-time decisions on billions of current data events and trillions of historical records.



“From the outset, we have designed our products in anticipation of vast increases in data volumes. It has always been our philosophy to make the most efficient use of existing hardware and to build in sufficient redundancy and flexibility going forward. This allows us to make full use of the multi-core systems being brought to market, without having to rewrite our software.”

Arthur Whitney, Co-founder, Kx Systems



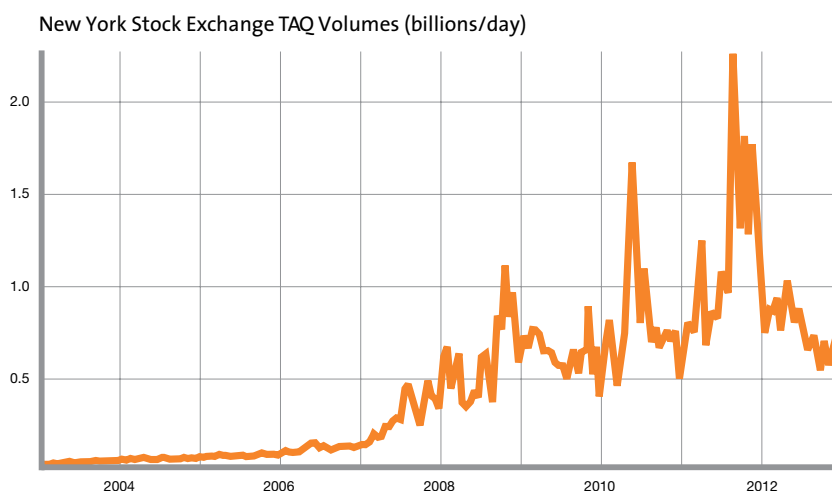
Big Numerical Data.

Massive data volumes, low-latency, and complex event processing have been recurring themes in recent years. In the financial services sector, for example, the New York Stock Exchange in the mid-1990s produced half a million trades and quotes per day; today this is typically half a billion, with peaks of over two billion records per day. Options traders now receive over 200 GB of data per day, while stock exchanges have built huge co-location data centers where dealers run algorithms directly on the data feeds, reducing latency to an absolute minimum.

In applications from capital markets trading to smart meters, telemetry, and biostatistical analysis, more sophisticated use is now being made of this kind of data. Algorithms are becoming more sophisticated, too, which further adds to the challenges. The available speed and power of equipment is increasing, but so are the demands placed on both software and hardware.

Kx Systems was founded in 1993 to address the inability of traditional relational database technology to keep up with these escalating volumes of data. The company's core product, kdb+, is built on a single architecture for both real-time and historical data. The database incorporates its own powerful query language, q, so that analytics can be run directly on the data. Over the years, Kx has delivered orders-of-magnitude improvements in performance to keep up with the rising data demand.

Today, Kx technology is often employed as the enterprise-wide market data server, or as a platform for OEM customers to deliver a wide range of software and services, including data analysis, investment, insurance and business performance monitoring.



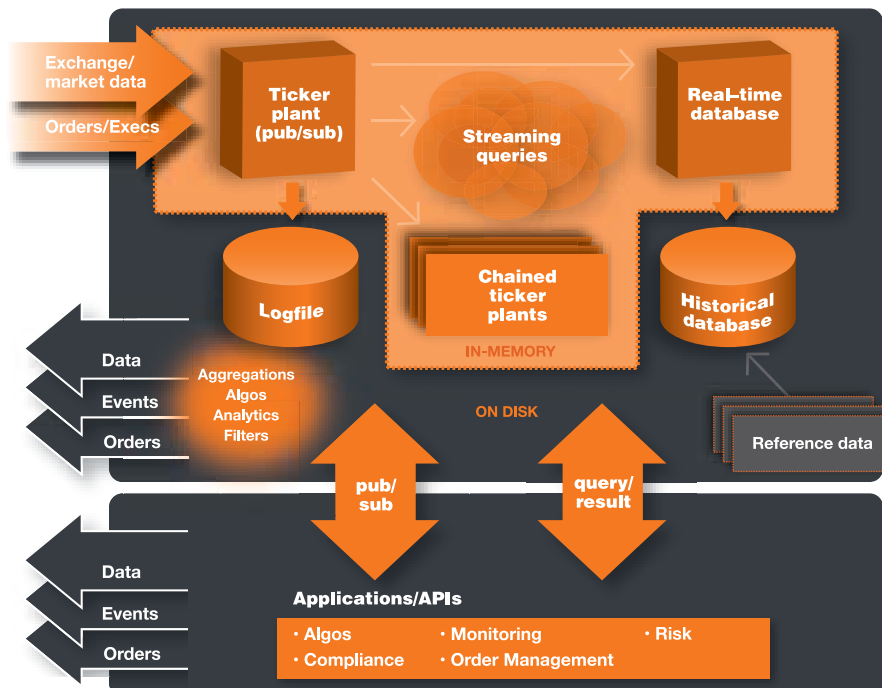
How it works

Extreme engineering

kdb+ runs on industry-standard Linux, Solaris, Windows, and Mac OS X 64-bit server platforms, and has no restrictions on storage architectures, as local disks, SANs, and NAS may be used and configured according to any preferences or corporate standards.

The software additionally has a small footprint, which makes it easily embeddable, as well as simple and straightforward to install, allowing the database to be set up and running in minutes.

- **Databases stored as ordinary native files** Database administration (for example, backup and recovery) may be done with standard operating system commands and utilities.
- **Simple API** Interfaces for C/C++, Java, .Net, R, Matlab, Perl, Python, WebSockets, and others make for easy connectivity to external graphical, reporting, and legacy systems; ODBC and JDBC facilitate interoperability with applications such as Excel.
- **Application-level handling of enterprise-level characteristics** Security, high-availability failover, transaction logging, and capacity planning enables kdb+ to fit easily with existing operations.
- **Supported on large-scale distributed architectures** These include clusters, grids, and clouds.
- **Built-in administrative tools** These include webserver, file operations, and communications.
- **Lower total cost of ownership** Virtually unlimited room to grow with short- or long-term profitability requirements.



Typical kdb+ architecture in financial trading application.

The language of power.

Kdb+ includes a general-purpose programming language, q, that has direct support for data-bases. This provides an enormous advantage over systems that force the user to rely on traditional SQL for data access, or that must depend on the supplier for pre-written queries. With q, end users can respond quickly to emerging needs.

- **Minimization of data traffic** Because q can operate on data directly, there is no need to first read data, then export to an external routine for analysis. Event processing can be done immediately, as data is received.
- **Virtually unlimited scalability** Lists, dictionaries, and tables are primitive data types, and the core primitives are designed for database operations — for example, doing arithmetic on tables. An operation can work just as easily on a million records, as on a single record.
- **Built-in time data types** Queries are highly optimized for time-series data.
- **Optimized performance** Data attributes such as sorted, parted, grouped, and unique can be applied to columns.
- **Query recognizability** q has database queries that are similar to counterparts in SQL, as well as functionality that goes far beyond traditional SQL.
- **Immediate feedback** The q interactive environment provides immediate feedback for rapid development.

“Kx has always ensured that its products make the best use of existing and upcoming hard-ware and technology, working closely with the R&D divisions of companies such as Intel. While constantly changing technology can place additional and unwelcome pressures on clients, Kx always tries to accommodate the new requirements within our software to protect and insulate clients from the disruptions caused by the evolution of new technologies.”

Charlie Skelton, Chief Technology Officer, Kx Systems

How it performs

A need for speed

As a single solution for real-time and historical data and analytics, kdb+ offers a significant performance advantage over competitive technologies. By managing all aspects of the process — data capture, storage, logging, event processing, and real-time analytics — kdb+ reduces the number of separate steps required to move and process data, thus minimizing latency from the point of data arrival to the completion of analytics.

With native 64-bit architecture — essential for managing today's massive data volumes — kdb+ enables performance to scale linearly: as the number of CPUs increases, built-in multi-core processing and multi-threading means that applications can take advantage of multiple cores without having to write special thread-aware code.

- **Efficient query distribution** With support for parallel access to large partitioned historical databases, queries can be farmed out to multiple cores/machines.
- **Dramatically faster search performance** A columnar structure simplifies indexing and joins.
- **Virtually unlimited clients** Publish and subscribe mechanisms offload processing from the main server onto chained servers, allowing data services to be provided to a virtually unlimited number of clients.
- **Speedy time-ordered analysis** With date, time, and timestamp (to nanosecond) as basic data types, time-ordered analysis is extremely fast.
- **Maximum data handling speed** kdb+ handles millions of records per second, billions per day, and trillions in a historical database. Its speed allows kdb+ to cope with spikes in the data flow; the database can also be used with hardware accelerators for even greater speed and flexibility.
- **Bulk insert and update optimization** Exchange data typically comes in blocks, and does not have to be written record by record. Also, the database does not need to be taken offline for bulk transactions.
- **Unparalleled data efficiency** Dynamic indices make efficient use of real-time data.

"It is vital to have software explicitly designed for multiple cores. Because kdb+ was designed from the beginning for parallel execution, it is extraordinarily fast when benchmarking against other traditional applications, as we are able to make full use of all available cores."

Simon Garland, Chief Strategist, Kx Systems

How it's used

Innovation +.

Kx products can be found in every market segment in which businesses require immediate access to both streaming and archived data: from finance and trading — where 9 of the world's top 10 investment banks embrace Kx technology — to energy, government, scientific research, and more.

A top-tier investment bank uses kdb+ not only as the core technology for many of the company's businesses — such as Foreign Exchange, Electronic Trading, Risk, and Structured Products — but also for enterprise-wide applications that support thousands of users, as well as front-, middle-, and back-office applications. Data extraction and analytics can now be done in minutes, allowing for more frequent analysis.

A prominent European investment bank after evaluating in-house solutions such as C++ based capture-and-storage mechanisms and fragmented, maxed-out relational technologies, decided to standardize its operations on Kx technology, giving their developers unprecedented control and flexibility. Today, in addition to capturing server performance metrics across the company's IT base, kdb+ is also used as a tick data platform, processing both traditional market and execution data from trading platforms, as well as metrics from trading engines for quant analysis.

A leading provider of cloud-based analytics takes advantage of the flexibility and versatility of Kx's vector language to build extremely fast and powerful analytical solutions for clients in finance, retail, manufacturing, and telecommunications. This provider values the importance of its open communication with the Kx Systems team, in which improvements to the technology come from both sides, ultimately allowing customers cloud-based solutions of extreme robustness and expressiveness.

A pioneer in the field of business process management uses Kx software to help its clients in telecommunications, government, and financial services rapidly design and execute repeatable processes — where analytic queries and high-speed, real-time reporting are of critical importance. Specifically, this provider takes advantage of the benefits of Kx technology — syntactic elegance, algorithmic performance, and simple, reliable construction — to create not only business possibilities, but also very real, and distinct, competitive advantages.

A leading provider of capital markets software and consulting made kdb+ the core part of its data management and trading software platform, which its clients have deployed in some of the world's largest banks, exchanges, and hedge funds. By re-engineering its FX trading platform, this provider saw immediate results in the throughput of its execution engine for applications such as reference and market data management, CEP, high-frequency trading, and more.

Customers first.

Kx is highly attentive to the needs of its customers, and takes pride in its reputation of being one of the most responsive vendors in terms of support; when issues are reported, there is a quick response — typically within minutes, and fuller solutions within the day — from someone who knows the code, as opposed to a scripted response from an outsourced support center.

- New development is driven by customer requests. The built-in file compression feature, for example, was requested by several Kx clients.
- There is an active email user forum where clients can post questions and discuss topics of interest to the community; and an active wiki for documentation, cookbooks, tutorials, and software add-ons.
- A 32-bit trial copy is freely available to allow anyone to learn the language. This is supported by the kdb+ personal developers group at <http://groups.google.com/group/personal-kdbplus>.

“What makes Kx technology so unique is that it requires a certain geometric intuition. Those who can take advantage of it are rewarded with the absolute fastest technology in the world. And, because the idea of linking tables across billions of rows of data is the same in any industry, this technology has applications that go far beyond any particular market or analysis.”

Joel Kaplan, Chairman, CTO, and Co-founder, 1010data

Team Kx.

In addition to joining with industry respected strategic partners who sell our products, Kx also partners with companies that build around kdb+ to offer a wide range of services and products that complement the database.

These services include comprehensive solutions in high-volume, high-performance database applications — from system configuration and application development to add-on solutions and proof-of-concept trials and support.

Additionally, we partner with training consultants who provide a wealth of education courses, at all levels of expertise, and with ISV partners — including HP, IBM, Intel, Oracle/Sun, and Microsoft — who offer ways for customers to link with kdb+ via “connecting” modules such as monitoring software, GUIs, user-friendly utilities, and more.

The result is a software, performance, and service ecosystem that is far greater than the sum of its parts.

For more information about Kx Systems, visit kx.com. Please contact us with any questions at sales@kx.com.



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