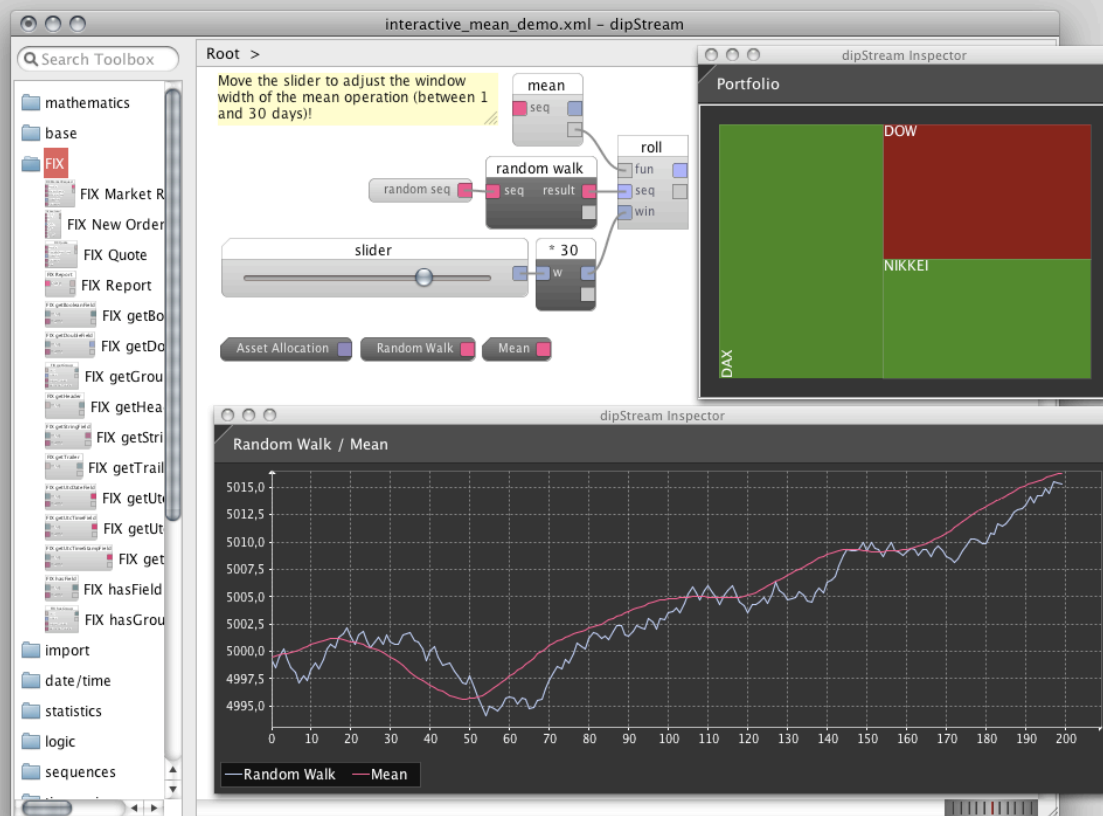


# DIPSTREAM

dortmund intelligence project



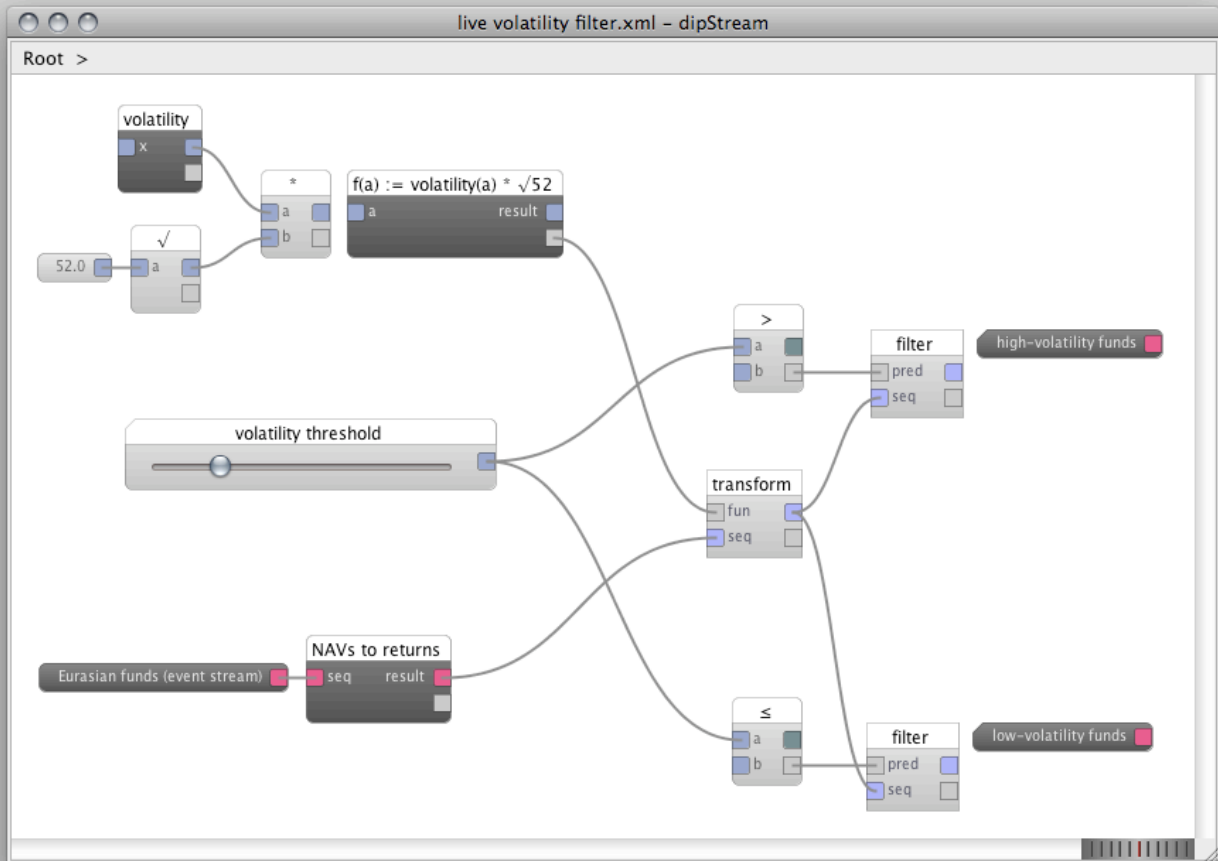
## dipStream™ next-generation stream processing

Financial market applications are all about timely reaction to data, prices and news. dipStream™ delivers unprecedented analytical, trading, and pricing power directly to the acting traders. The system offers risk management, algorithmic trading, market making, pricing, real-time analytics, charting and reporting for multi-asset-class and cross-asset-class instruments.

Research, development and implementation of financial market applications is a complicated and time-consuming process involving multiple parties. Even with modern tools, it takes weeks or months to complete, a timeframe intolerable in today's rapidly changing markets. For the first time, dipStream™ empowers business users to research, develop, deploy, and execute complex financial market applications themselves, without support from an IT department.

### dipStream™ Highlights

- ▶ empowers business users to rapidly develop complex financial market applications themselves, without support from an IT department
- ▶ perfect for algorithmic trading, option pricing, risk management, portfolio management and real-time analytics
- ▶ simultaneous processing of multiple data streams of different type and frequency for multi-asset-class and cross-asset-class instruments
- ▶ comprehensive extendable library of pre-defined functions for financial analysis, statistics and mathematics
- ▶ expressive graphical development language
- ▶ seamlessly connects to existing backend infrastructure and to the web
- ▶ powerful and customizable dynamic charting and reporting



"Applications, consisting of user-defined indicators, rules, and functions are defined in an easy-to-use graphical diagramming language. This makes the construction of complete financial market applications as simple as drawing a flow-chart."

Applications, consisting of user-defined indicators, rules, and functions, are defined in an easy-to-use graphical diagramming language, rendering the construction of complete financial market applications as simple as drawing a flow-chart. This diagram language is based on modern research in Functional Programming and offers unprecedented expressivity, meaning that complex processes can be effectively modelled in very few steps. To give the user a head start, a comprehensive library of pre-defined functions for financial analysis, statistics and mathematics is included.

dipStream™ supports simultaneous processing of multiple data streams of different type (stocks, indices, rates, commodities, news, etc.) and frequency (ticks, n-minute bars, daily bars, etc.) allowing business users to easily define multi-asset strategies. Users can easily define their own data types and frequencies. dipStream™ does not stop at integrating data of various, formerly incompatible type: It also integrates methods and techniques from fields like economics, statistics, mathematics and artificial intelligence.

The application development process is fully interactive, in the sense that applications can be modified

while executing on live data streams, enabling rapid exploration and evaluation of alternative approaches. No other system on the market offers this flexibility.

Solutions can be easily verified by backtesting on recorded stream data stored in a central SQL database, or on any other user-supplied data. During and after development and backtesting, indicators, rules, functions, and applications are stored in a central SQL database. This allows different users to integrate, modify and extend these indicators, rules, functions and applications in their own solutions.

After the development process, applications are seamlessly deployed on production servers to execute continuously on real-time data streams. dipStream™ dynamically generates automatic charts and reports based on user-defined templates for all deployed applications. These reports are easily accessible from a web interface as well as from existing front-end and back-end systems.

Another business benefit of dipStream™ is intelligent, competitive pricing of financial instruments - dynamically recalculated in response to market changes.

## application areas

integrate techniques and methods from different fields to create novel and innovative solutions

dipStream's™ flexibility and unique feature set makes it a perfect match for a large array of application areas, including:

**ALGORITHMIC TRADING** dipStream™ takes custom algorithmic trading systems development to a new level of flexibility, observability and efficiency.

Indicators and signal generating functions are defined graphically and can be immediately (back-)tested on live real-time or historical ticker data. All intermediate results are directly observable all the time, using the same charting and reporting functionality that is employed when viewing end results.

dipStream's™ support for the simultaneous processing of multiple data streams of different type and frequency enables the development of multi-asset-class and cross-asset-class strategies. Custom algorithmic trading strategies can even act on user-defined input stream types, e.g. weather data or keywords in financial news streams.

Algorithmic trading systems are executed efficiently by dipStream's™ highly optimizing kernel even when still in development, allowing for realistic performance assessments on real-time data throughout the entire

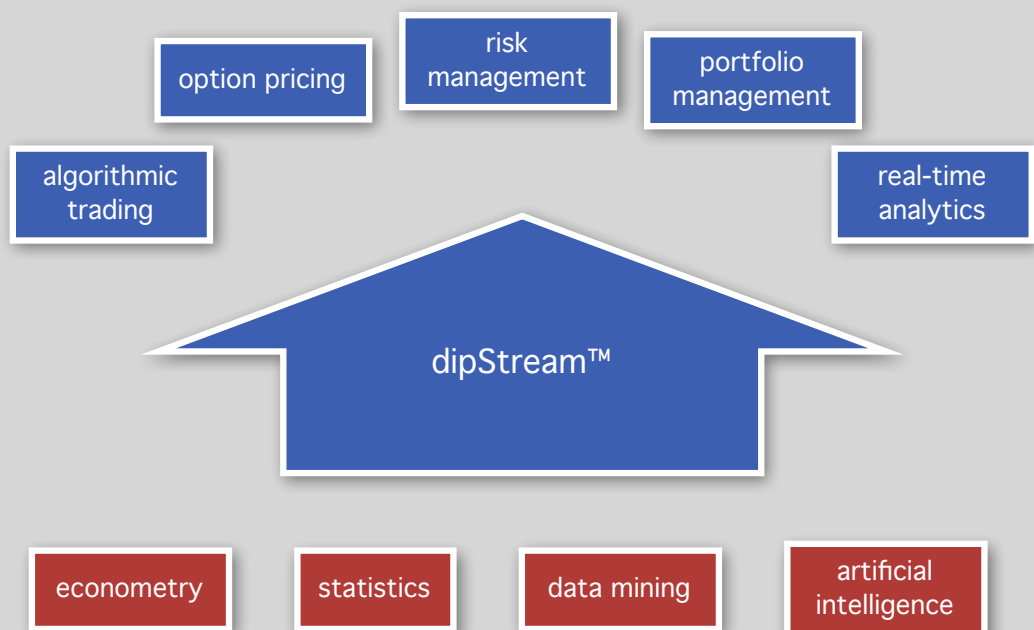
development process. This renders performance issues that only appear late at deployment time a problem of the past.

**OPTION PRICING** The pricing of options, as well as general contract valuation are complex problems that are solved by often even more complex tools. dipStream's™ unique *Visual Function Composition* approach allows much simpler solutions by exploiting the fact that complex contracts can be described as certain combinations of simpler contracts. These, and the contract valuation models themselves, can then be defined in the graphical diagramming language. The result is a custom option pricing system that is easily extended by business users to support new option types.

dipStream™ simplifies the development of large and complex applications by intuitive means for creating powerful generic user-defined functions, which are then used to hierarchically structure and solve very complex problems.

By defining functions and storing them in a central database for later reuse, users in an organization naturally collaborate to build a growing toolset of custom functionality.

"Alltogether, dipStream™ offers the freedom to integrate and combine methods from different fields in novel and innovative ways, and to apply them in a large array of application areas."



"dipStream's™ visual interactive development process dramatically simplifies financial market application development. For the first time, business users are empowered to research, develop, deploy, and execute complex financial market applications without support from an IT department."

## dipStream™ process

visual interactive development

## conventional process



time →

**RISK MANAGEMENT** The implementation of formal financial risk modelling is a challenging task that many organizations face today, not least due to new regulatory accounts (e.g. Basel II). In financial risk management, one solution does not fit all, a fact often leading to costly in-house development efforts.

dipStream™ enables business users to implement state-of-the-art financial risk management solutions tailor-made for their special requirements. The system already includes implementations for classical risk modelling methods such as value-at-risk (VaR), historical simulation (HS), and extreme value theory (EVT), for users to build on. Functionality from dipStream's comprehensive library of pre-defined functions can be effortlessly combined with functionality defined in-house.

dipStream's™ efficient and scalable execution kernel supports modern computationally intensive methods that require the processing of vast amounts of historical data and live data, leading to exact and up-to-date risk assessments.

**PORTFOLIO MANAGEMENT** dipStream™ facilitates the automation of custom portfolio selection and optimization strategies by integrating access to data providers such as Morningstar® and Bloomberg®. The system easily supports the implementation of classical Markowitz methodology as well as Post-Markowitz approaches. Furthermore, methods from artificial intelligence, such as Evolutionary Computation, can be employed to

create even more advanced portfolio selection and optimization processes.

Additionally, dipStream's™ graphical diagramming language is flexible enough to easily express data mining methods for the classification and clustering of very large fund universes.

**REAL-TIME ANALYTICS** dipStream™ includes powerful support for dynamic charts and reports and combines this with a large, user-extensible library of functions for econometrics, statistics, mathematics, data mining and artificial intelligence.

All these functions - included and user-defined - are applicable to real-time data of appropriate type.

Users are empowered to answer complex questions on the basis of real-time and historical data of arbitrary type and frequency by applying modern data mining and statistical methods. Therefore the system is ideally suited for developing complete decision-support systems.

Alltogether dipStream™ offers the freedom to integrate and combine methods from different fields in novel and innovative ways, and to apply them in a large array of application areas. The system's unique feature set puts the power to timely and efficiently develop complex financial market applications in the hands of business users.

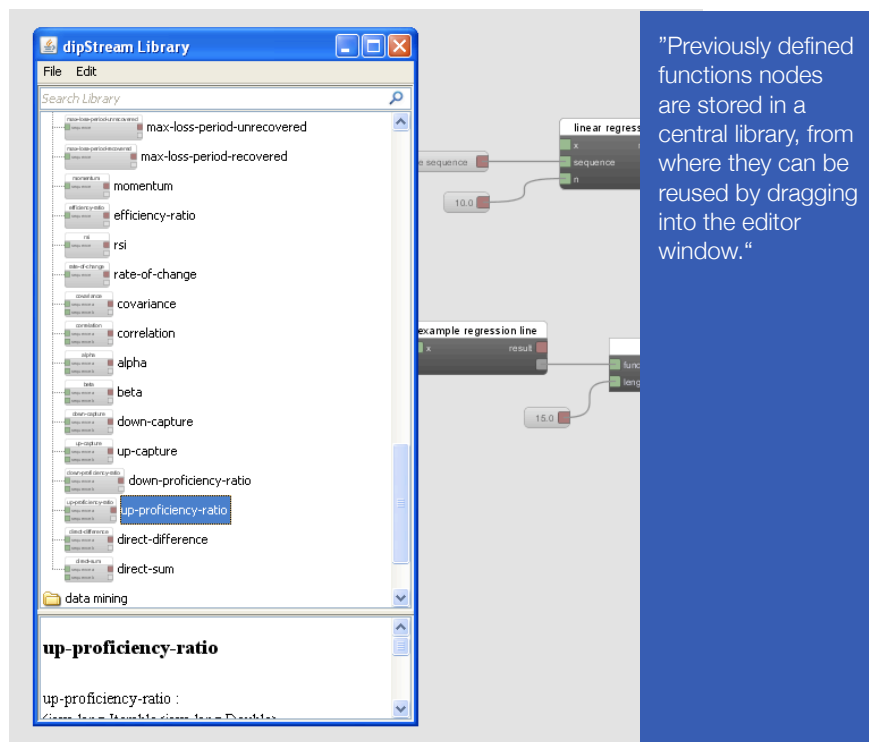
## unmatched flexibility rapidly develop complex financial market applications

dipStream™ owes its power and flexibility to *Visual Function Composition*, a novel conceptual approach to financial market application development, invented by DIP.

The entire financial market application development process in dipStream™ is based on a single powerful concept: The combination of constants and functions in hierarchical networks. These functions include simple arithmetic operations like addition or multiplication, econometric operations like VaR or RSI, and operations combining other functions like time series "rolling" or conditional application. A ticker data provider is naturally represented by a function taking a ticker symbol as its input and producing a real-time data stream as its output.

In practice, functions are represented graphically, as nodes in a network diagram. Function nodes offer input and output ports, constants are simply functions without input ports. The data flow between functions is represented by arcs wiring output ports to input ports.

Functions nodes are evaluated, or "run", by double clicking on their graphical representation. Depending on the type of the result, a matching dynamic visualization is



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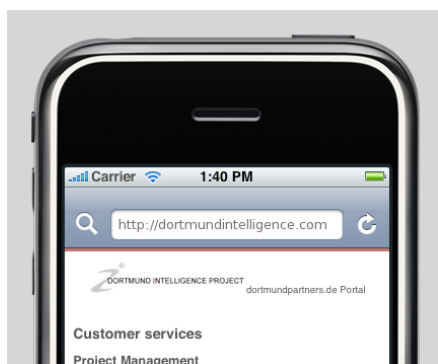
created, presented and continuously updated. These visualizations can be combined into larger dynamic reports and freely customized. Functions may produce static as well as time-varying values, such as data streams or event streams.

Previously defined function nodes are stored in a central library, from where they can be reused by dragging into the editor window. New functions are defined by evaluating a function node without connecting all its input ports, resulting in a specialized function. This process can be nested, leading to hierarchical networks of functions.

Definitions of all functions are kept accessible all the time.

The development process is fully interactive, in the sense that functions and function network diagrams can be edited while processing live stream data. Explorative development and the discovery of innovative solutions becomes easy and natural.

To further aid development, dipStream™ includes online documentation for each included function, support for documenting user-defined functions, and the *LightGuide* system that highlights valid connections of function node ports.



"Financial market applications developed in dipStream™ are automatically web-enabled. Users can monitor and use their applications in near-realtime from any web-enabled device."

## infinite connectivity connect to your solutions - wherever you are

People expect modern software systems to be accessible anytime, from anywhere in the world. In the past, this requirement often lead to additional development costs. In contrast, financial market applications developed in dipStream™ are automatically web-enabled. Users can monitor and use their applications in near-realtime from any web-enabled device. This includes of course modern

smartphones like BlackBerry® and iPhone®.

At the same time, dipStream™ seamlessly connects to existing backend infrastructure, like data providers and trading systems. A highly modular architecture based on industry-standard Java™ technology, paired with strict adherence to modern Webservice standards (including SOAP and REST), assures trouble-free interoperability with service oriented architectures (SOAs) of today and of the future.

"dipStream's™ unique feature set puts the power to timely and efficiently develop complex financial market applications in the hands of business users."



## unlimited extensibility

expand your reach with standard and in-house function packages

Related functions are organized in function packages for convenient management. Packages and individual functions are stored in a library backed by a central database. Because constants are handled as inputless functions, this database also stores arbitrary application data, such as recorded ticker data for backtesting purposes, option type definitions for option pricing applications, or portfolio histories for portfolio management systems.

While dipStream™ already includes a rich variety of functions and packages for econometry, mathematics, statistics, data mining, and artificial intelligence, users can extend the system by defining in-house packages capturing the requirements of special application areas.

For example, DIP developed packages for:

- portfolio optimization via evolutionary computation methods (evolution strategies and genetic algorithms)
- automatic report generation and distribution

- accessing news and price data on the web and communicating events over email and SMS
- writing data to and reading data from SQL-databases (Oracle, DB2, PostgreSQL, etc.)
- grid- and cloud-computing for unlimited horizontal scalability
- clustering and visualizing large fund universes using state-of-the-art machine learning methods
- algorithmic trading in FX markets



DIP Dortmund Intelligence Project GmbH  
Joseph-von-Fraunhofer Str. 20  
44227 Dortmund  
+49 231 9700 978  
[info@dortmundintelligence.de](mailto:info@dortmundintelligence.de)  
[www.dortmundintelligence.de](http://www.dortmundintelligence.de)