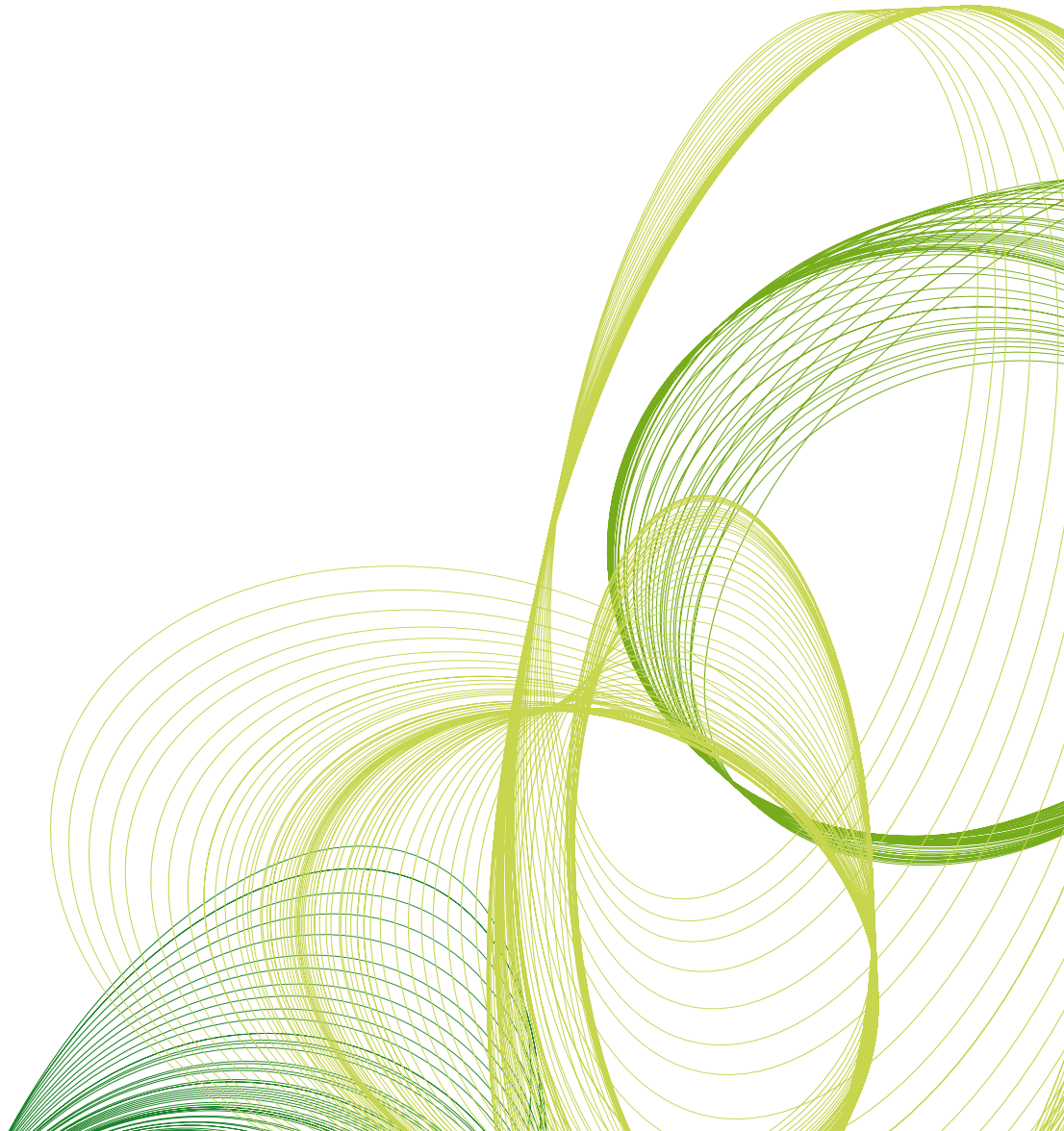# QlikView

Next Generation Business Intelligence
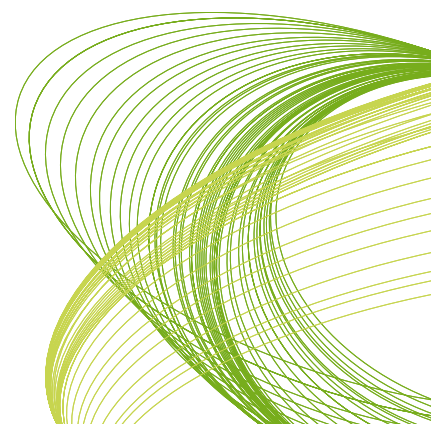
Technical Overview White Paper

How QlikView In-Memory Analysis Ushers in The Next Generation of Business Intelligence

Executive Overview

The business world is moving faster and growing more complex. Competition grows more fierce; customers more fickle. Product lines have multiplied, with shorter life cycles. Operations are geographically dispersed or outsourced altogether. M&A activity has accelerated. Regulations are more stringent, and compliance reporting – with corresponding audit trails – more cumbersome.

The supporting technology landscape is consequently more complicated. ERP systems have become the operational backbone of most organizations, with a myriad of custom, customized and internally developed add-on applications for specific functions. Suppliers' systems often feed directly into internal systems, and customers want open access as well.

Information is expected on-demand to match the speed of business. But that information is often nonintegrated and hidden – locked within different data sources, conflicting reporting structures, departmental spreadsheets – clouding the true picture of operational and financial situations.

These gaps create operational inefficiencies and increased overhead. As important, they have their own opportunity cost – obscuring the insights that can spark a new product to meet a market gap, retain customers' loyalty or create a more efficient supply chain.

Business Intelligence (BI) applications were created specifically to break through the clutter of data and give business managers actionable information, which ushered in a host of both internally-developed and packaged solutions more than a decade ago. As in most other application categories, the make vs. buy debate tipped in favor of packaged solutions for a majority of companies.

BI has now moved up to being the number one solution priority in supporting and delivering on nine of the top 10 business opportunities, according to Gartner[1]:

Top 10 Technology Priorities 2006*
01. Business Intelligence applications
02. Security technologies
03. Mobile workforce enablement
04. Collaboration technologies
05. Customer sales and service
06. Service Oriented Architectures (SOA)
07. Workflow management
08. Networking, voice and data communications
09. Virtualization
10. Legacy application modernization

Top 10 Business Priorities 2006*
01. Business process improvement
02. Controlling enterprise operating tools
03. Attracting and growing customer relationships
04. Improving competitive advantage
05. Improving competitiveness
06. Using intelligence in products and services
07. Security breaches and disruptions
08. Revenues growth
09. Faster innovation
10. Faster innovation and cycle times

*Source: Gartner EXP (January 2006)1 Gartner Executive Programs Survey of 1,400 CIO's, January 2006

Frustrations have grown, however, with the "traditional" BI options: Implementations take months and millions of dollars. And after the applications are deployed, the complicated burden of changing reports to meet the dynamic needs of business managers falls to already overstretched IT resources. In practice, "on-demand" business reporting is anything but, impacting all areas of the business.

In large part, the failings of traditional BI applications lie in their inherent design. Many of today's popular OLAP (Online Analytical Processing) applications are based on an architecture that was developed to spare expensive memory and accommodate slow computer processing. Fundamental changes in technology, from faster and cheaper processor speeds and memory chips to zero-footprint web deployment, have made that design paradigm obsolete.

QlikTech has been a leader in harnessing and exploiting next generation architectures. As a result, QlikTech's next generation approach is completely aligned with – and ahead of – the industry with fast, powerful and affordable analysis for everyone in the organization.

QlikView offers a complete analysis solution – dashboards and alerts, multi-dimensional analyses, slice-and-dice of data – without the limitations, cost or complexity of traditional OLAP cubes. Solutions can be deployed in days, users can be trained in minutes, and end users get answers in seconds – not hours – to refine their decisions.

QlikView is able to analyze massive amounts of data at unprecedented speed because of its in-memory data model design. As a result of this design, users get sub-second response times on queries and calculations and the ability to process massive datasets; companies can deploy to large user populations quickly and affordably.

By taking full advantage of 64-bit technology's memory capacity, QlikView can provide summary level metrics and record level detail on the same architecture. Companies gain scalable business analysis solutions that provide summary KPIs as well as highly granular, detailed analyses.

In a recent Research Note, Gartner predicted, "Organizations will incorporate in-memory technology into their business intelligence (BI) applications to optimize performance and flexibility. In particular, in-memory technology will be applied to BI applications that require analyzing large amounts of detailed data, such as Web analytics, point of sale and radio frequency identification. As more BI and database vendors embrace this approach, organizations will find it easier to convert BI applications based on traditional disk aggregation techniques."[2]

This paper provides an overview of QlikView, addressing:
• The Business Failure of Traditional BI – and how its design actually hinders business performance
• In-Memory Analysis – what makes "next-generation" BI more effective
• An Overview of QlikView – including its user interface and architecture
• QlikView in Action – how companies are using and reaping benefits from QlikView

[2] Kurt Schlegel, Mark A. Beyer, Andreas Bitterer and Bill Hostmann (October 2, 2006). "BI Applications Benefit from In-Memory Technology Improvements," Gartner
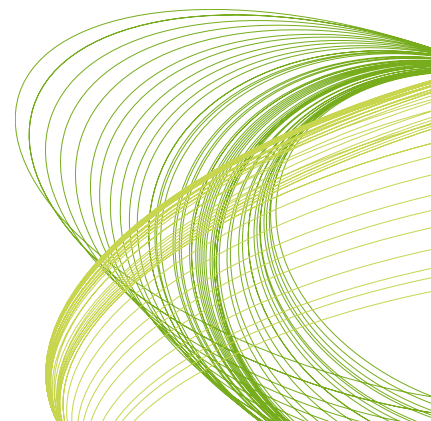
The Business Failure of Traditional Business Intelligence

A recent article in Intelligent Enterprise magazine captured the three major issues of today's traditional BI solutions: 1) Data reporting has been an afterthought to using core business applications on a day-to-day basis, breaking the "link between insight and action." 2) Consolidating disparate tools into a suite isn't enough to give business users the information they need. Search and semantics need to be integrated. 3) "Build it and they will come" doesn't provide insight, just more technology. BI needs to answer the needs of decision makers, and needs to deliver incremental successes along the way.[3]

These factors, among others, have undoubtedly led to the dismal performance in BI initiatives. According to a study published in DM Review, a leading business intelligence publication, the average total implementation time for BI initiatives is 17 months, with five months to deploy the first usable analytic application. The average total annual cost of implementation is a staggering $1.1 million for companies with more than 1,000 employees. And at best, according to the survey, is a 31% success rate for internally built BI/DW systems; purchased operational analytic applications are considered successful a mere 12% of the time.[4]

Figure 1: Total Implementation Time for Traditional BI
How long did it take to implement your business intelligence initiative?
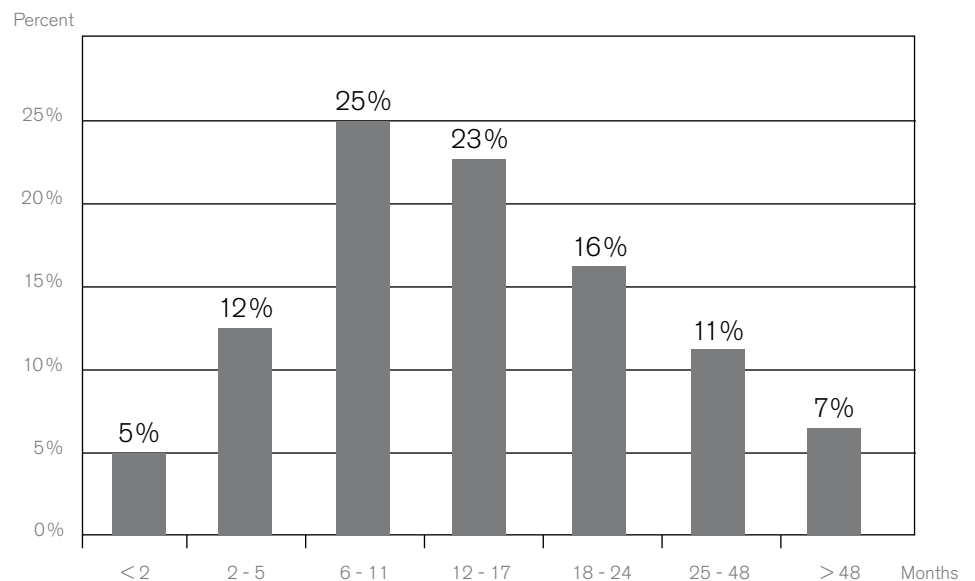

Source: DM Review

[3] *Neil Raden (September 1, 2006). "BI Megatrends," Intelligent Enterprise Magazine.*
*Website: http://www.intelligententerprise.com/channels/bi/showArticle.
jhtml?articleID=192200066*
[4] *DM Review & IDC Business Intelligence Survey, October 2004 & 2006*

These failed initiatives cost more than money and resources – they hamper business performance in nearly every way. A summer 2005 survey of 385 finance and IT executives, by CFO Research Services asked respondents to identify the drivers of poor information quality (IQ). Nearly half the survey respondents – 45 percent – cite disparate, non-integrated IT systems and the variability of business processes as an acute problem that constrains management's ability to work effectively and focus on high-value activities. Approximately the same number agrees that finance and business units alike spend too much time developing supplemental reports and analysis. Other disappointing and productivity- sapping by-products of poor information quality include "multiple versions of the truth," misguided incentive programs, and unrealistic plans and budgets In fact, 61 percent of respondents say they could still do a better job of just making sure the financial information they generate accurately reflects the performance of their businesses. The business impact of this poor IQ, say respondents, includes widespread decision-making problems that are often tied to inaccurate, untimely, and irrelevant information.[5]

Figure 2: Implications of Poor Information Quality
To what extent do you believe your management suffers from the following decision-making problems?

Source: CFO Reserch Services
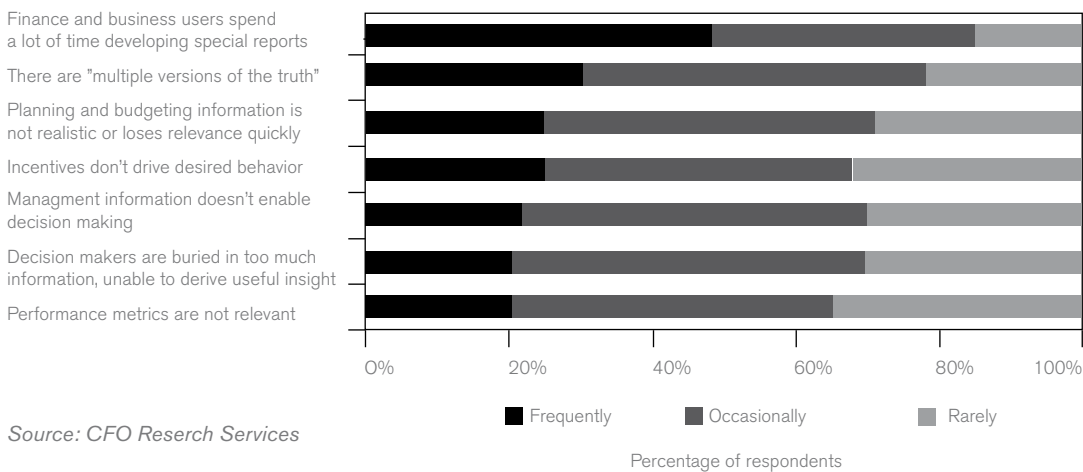
[5] Randy Myers (Summer 2005). "IT Executives Seek to Boost Information Quality", CFO Research Services. Website http://www.cfo.com/article.cfm/5545859/c_2984335/?f=archives
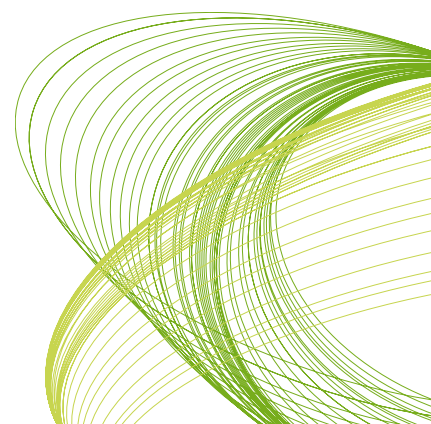
The Next Generation of Business Intelligence

The OLAP Tradition

Twenty years ago memory was expensive and processors were slow. Faced with these constraints, developers at the time devised an architecture for delivering results of multi-dimensional analysis which relied on pre-calculating fixed analyses. Simply put, they pre-calculated all measures across every possible combination of dimensions. For example, for total sales by sales person and region, the system would calculate total sales for each sales person for each region, and for every union of sales person and region. The results of these calculations were stored and retrieved when an end user requested a particular "analysis." This is what is traditionally referred to as "calculating the cube" and the "cube" is the mechanism which organizes and stores the results. Because the results were pre-calculated, regardless of how long in took to calculate the results, the response time from the perspective of the end user was instantaneous.

The Enabling Technology or Change Agent

Today, we have a fundamentally different technology platform available to us on which to build business intelligence. Specifically three things have happened:

First, Moore's Law has relentlessly beat its drum – resulting in processors which are significantly faster today than they were twenty years ago and memory which is significantly less expensive. The difference in price/performance for both factors is well over a factor of 1,000 higher today than it was then.

Second, the mainstream availability of 64-bit processors raises the amount of memory a computer can utilize. A 32-bit processor can use four gigabytes of memory at a maximum, and a portion of that must be devoted to the operating system. A 64-bit processor can use 17,179,869,184 gigabytes or 17 exabyte of RAM – a factor of four billion more. Of course, the practical limitation of computers available today is much lower, but machines with 40, 80, or even 120 gigabytes of memory are readily available for less than $30,000.

Third, hardware manufacturers have shifted from computers with a few fast processors to computers with multiple lower-power, lower-speed processors. The challenge today is keeping computers operating at a reasonable temperature. The strategy for achieving this goal is to equip computers with many lower power processors working in parallel. Today, it is common to find computers with 2, 4, 16, 32 or even 128 processors. In addition, newer processors have multiple "cores" bundled on a single chip.

QlikView's Premise: In-Memory BI

QlikView was built with a simple architectural premise – all data should be held in memory, and all calculations should be performed when requested and not prior. Twenty years ago this would have been impossible. In 1993, when QlikTech was founded, it was still a pretty crazy idea. But now, the trends in the underlying platform (referenced in the previous section) have lifted the constraints so that organizations of all sizes can now benefit.

QlikView's patented technology is based on an extremely efficient, in-memory data model. High-speed associations occur as the user clicks in the applications and the display is updated immediately, allowing users to work with millions of cells of data and still respond to queries in less than a second.

As a result of this design, QlikView removes the need to pre-aggregate data, define complex dimensional hierarchies and generate cubes. QlikView performs calculations on the fly, giving the power of multidimensional analysis to every user, not just the highly trained few.

By taking full advantage of 64-bit technology's memory capacity, QlikView can provide summary level metrics and record level detail on the same architecture. Companies gain infinitely scalable business analysis solutions that provide summary KPIs as well as highly granular, detailed analyses.

In its recent Research Note, leading analysts at Gartner reported on the value of this approach: "Our research indicates that query performance using this in-memory method is often just as fast as or faster than traditional aggregate-based architectures. In-memory technology not only retrieves the data faster, but it also performs calculations on the query results much faster than disk-based approaches...Therefore, with in-memory technology, users can freely explore detailed data in an unfettered manner without the limitations of a cube or aggregate table to receive good performance."[6]

Benefits of Next Generation BI

The QlikView solution, because of its unique integrated components and because it operates entirely in memory, offers some unique advantages over traditional OLAP:

Fast Time-to-Value: With traditional OLAP, constructing cubes is time consuming and requires expert skills. This process can take months, and sometimes over a year. In addition, the cube must be constructed before it can be calculated, a process which itself can take hours. And, all this must occur before analysis or reporting can be performed – before the user even sees answers to his questions. Because the data is loaded in memory, creating analysis in QlikView takes seconds. There is no pre-definition of what is a dimension – any data is available as a dimension and any data is available as a measure. The time implementing QlikView is spent locating data, and deciding what analysis is interesting or relevant to solving the business question. Typically, this process takes only a week or two.

Easy to Use: The entire end user experience in QlikView is driven by the "click." End users enjoy using QlikView because it works the way their mind does. Each time they want to review the data sliced a new way, they simply click on the data they want to evaluate. Because QlikView operates in memory, with each click all data and measures are recalculated to reflect the selection. Users can go from high level aggregates (e.g., roll up of margin on all products in a specific line) to individual records (e.g., which order was that?) in a click – without pre-defining the path to the individual record. The QlikView UI uses color coding which provides instant feedback to queries.

[6] Kurt Schlegel, Mark A. Beyer, Andreas Bitterer, Bill Hostmann, Gartner, Ibid.
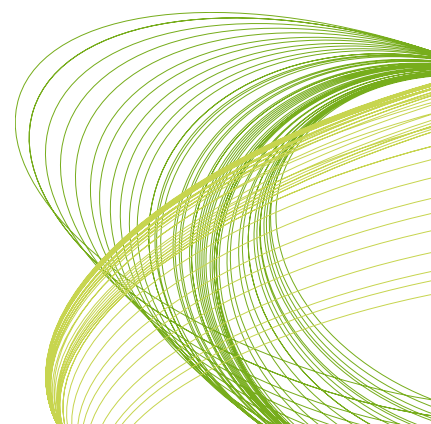
Powerful: Because queries and calculations are performed in memory, they are extremely quick. In addition, QlikView is not constrained by the speed of the underlying source. Even if the underlying data is stored in a system which has poor query performance (for instance, a text file), the performance is always optimal because the data is loaded in memory. QlikView also compresses data as it is stored in memory, allowing large amounts of data to be stored. Typically, there is a 10X reduction in size of the data once it's in memory.

Flexible: One of the major issues with traditional OLAP is that modifying an analysis requires changing the cube, a process which can take a very long time. In addition, this process is typically controlled by IT. With QlikView, viewing analysis by a new dimension or changing a measure can be performed by business professionals in seconds. Standard interfaces, including ODBC and Web Services, mean that any data source can be analyzed in QlikView. What's more, users can do "local" or "desktop" analysis, using the full data and interactivity of the application on laptops.

Scalable: QlikView is designed to scale easily in both the amount of data it can handle, and the number of users working with it. It's simple to deploy to thousands of users – utilizing all available hardware power across all available processors and cores, requiring only a web browser.

Figure 3: Key Features & Benefits of QlikView

Key features	Key benefits
Point-and-click user interface	Easy-to-use data analysis which requires little to no end user training
QlikView for 64-bit platforms	64-bit QlikView for loading and analyzing massive datasets
Bookmarks and one click data export to Excel	Use QlikView bookmark and export features to share knowledge with colleagues
Report editor	Use QlikView to maintain a single environment for consistent and simple reporting, analysis applications, and power analysis
Alerts	Proactively alert end users to important changes in underlying data
Zero-footprint, no install, DHTML	Fully interactive end user QlikView experience with no client side software

QlikView is ushering in the next generation of business intelligence with fast, powerful and visual analysis that's simple to use. QlikView's patented technology offers all of the features of "traditional" analytics solutions – dashboards and alerts, multi-dimensional analyses, slice-and-dice of data – without the limitations, cost or complexity of traditional BI applications. QlikView solutions can be deployed in days, users can be trained in minutes, and end users get results instantly.

The QlikView Platform

QlikView offers all of the capabilities that traditionally required a complex and costly suite of products, on a single unified platform. QlikView provides flexible ad-hoc analysis capabilities, powerful analytic applications, and simple printable reports. This allows organizations to deploy QlikView to everyone – highly skilled analysts doing ad-hoc detailed reporting, executives requiring a dashboard of critical business information and plant supervisors analyzing output performance. Further, QlikView allows organizations to eliminate unused paper reports, and replace them with demand-driven reporting.

An Overview of QlikView

Figure 4: QlikView Platform Overview:
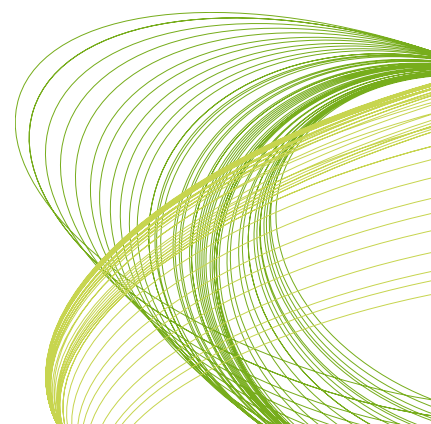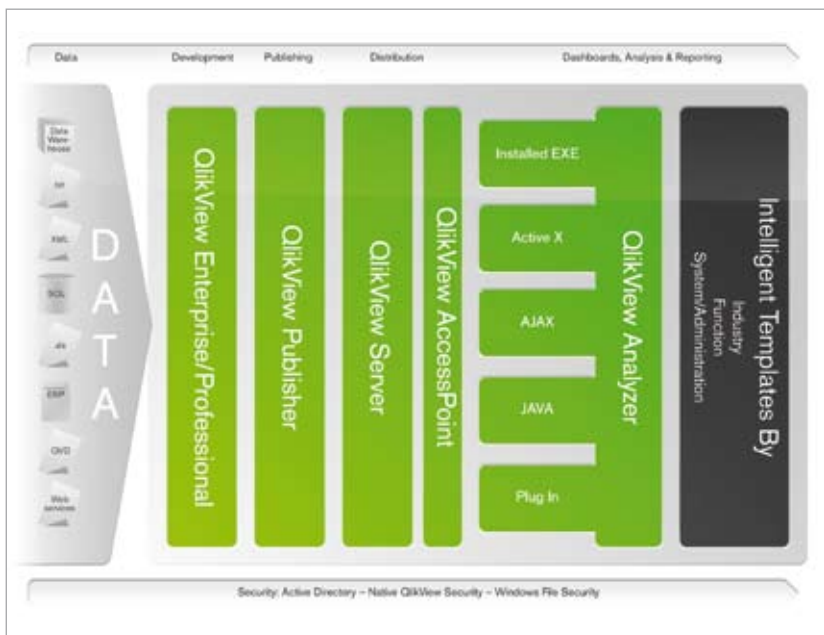
QlikView Enterprise – For the developer

QlikView Enterprise is the complete developer's tool for building QlikView applications. QlikView Enterprise lets developers load disparate data sources for access in a single application. The data load script supports over 150 functions for data cleansing, manipulation and aggregation. An intuitive, wizard-driven interface allows powerful, visually interactive applications to be developed quickly.

QlikView Publisher – For distribution

QlikView Publisher ensures that the right information reaches the right user at the right time. As the use of business analysis spreads throughout the organization, controlling the distribution of analysis becomes increasingly important. QlikView Publisher allows for complete control of the distribution of a company's QlikView applications, automating the data refresh process for QlikView application data. In addition, it ensures that applications are distributed to the correct users when they need them.

QlikView Server – For security

QlikView Server is the central source for truth in an organization. With today's distributed workforce, QlikView Server provides a simple way for organizations to ensure that everyone has access to the latest data and analysis regardless of their location. Regardless of the client chosen whether zero-footprint DHTML, Windows, ActiveX plug-in, or Java – QlikView Server provides access to the latest version of each QlikView application.

QlikView Professional – For the power user

QlikView Professional lets power users build, change or modify the layout of existing QlikView applications. QlikView Professional users can refresh existing data sources, and can choose to work with either local applications or applications distributed via QlikView Server. Power users can work with local data, including offline enterprise applications, with no limitations.

QlikView Analyzer – For the general user

QlikView Analyzer lets end-users connect to server-based QlikView applications. QlikView Analyzer has a number of deployment options, including Java clients (supporting Sun and MSFT Java), plug-in for MSFT IE and AJAX zero-footprint clients. The installed Analyzer EXE client also provides offline analysis and reporting capabilities.

QlikView Architecture

Most traditional databases are built upon a relational model. Records are broken apart to reduce redundancy and key fields are used to put the records back together at the time they are used. Database programmers are required to make tradeoffs between increased speed at the cost of more space and more time to add or edit records, and the database user often suffers based on these decisions.

QlikView was built with a simple architectural premise – all data should be held in memory, and all calculations should be performed when requested and not prior. QlikTech's goal is to deliver powerful analytic and reporting solutions in a quarter of the time, at half the cost, and with twice the value of competing OLAP cube based products.

QlikView is designed so that the entire application (data model included) is held in RAM – this is what makes it uniquely efficient compared to traditional OLAP cube-based applications. It creates an in-memory data model as it loads data from a data source, enabling it to access millions of cells of data and still respond to queries in less than a second. High-speed associations occur as the user clicks in the various sheet objects and the display is updated immediately.

QlikView operates much faster and requires significantly less space than an equivalent relational database because it optimizes the data as it loads – removing redundant field data and automatically linking tables together. Indexes are not required, making every field available as a search field without any performance penalty. Because of this design, QlikView typically requires a tenth of the space required for the same data represented in a relational model, i.e. 100GB data fits into 10GB of memory. There is no limit to the number of tables allowed in an application, or to the number of fields, rows or cells in a single table. RAM is the only factor that limits the size of an application.

QlikView offers three components in an integrated solution:

Fast Query Engine: Loading the data into memory allows QlikView to query, or sub-set, the data instantly to only reveal the data which is relevant to a given user. In addition, QlikView shows users the data which is excluded by a selection.

On Demand Calculation Engine: Charts, graphs, and tables of all types in QlikView are multidimensional analysis. That is, they show one or more measures (e.g., metrics, KPIs, expressions, etc.) across one or more dimensions (example: total sales by region). The major difference is that these calculations are performed as the user clicks and never prior.

Visually Interactive User Interface (UI): QlikView offers hundreds of possible chart and table types and varieties; there are list boxes for navigating dimensions; statistic boxes; and many other UI elements. Every UI element can be clicked on to query.

Figure 5: QlikView Architecture Overview

## QlikView Technical Features

Data and Data Loading

QlikView loads data directly from most data sources (i.e., ODBC and OLEDB sources, using vendor specific drivers), any text or table data file (i.e., delimited text files, Excel files, XML files, etc.), and any formats, as well as data warehouses and data marts (although these are not required). QlikView also offers a plug-in model for loading custom data sources (web services).

QlikView is designed to handle a remarkable amount of data. There is no limit to the number of tables allowed in an application. In addition, there is no limit to the number of fields, rows or cells in a single table – QlikView can handle billions of unique values in a given field. RAM is the only factor that limits the size of an application.

The maximum size of a QlikView application is closely tied to the available RAM on the system where the application will run. However, it is not as easy as looking at the size of a relational database and comparing that to the RAM on the system to determine if the application is appropriate for QlikView. As QlikView loads data from a source database, the data is highly compressed and optimized, typically resulting in a QlikView application of only 10% of the size of the original source.

Traditional OLAP cubes can take half a day to load even tens of millions of records. Benchmarks with QlikView have demonstrated data loads as high as 4 million records per second. This innovation allows unprecedented speed in incremental data loads, reducing the load on underlying data sources and allowing more frequent data refreshes.
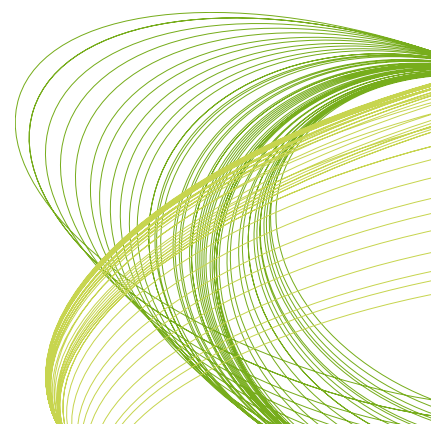
Load Script

QlikView can load data that is stored in a variety of formats, as mentioned above. Data can be loaded from generic tables, cross tables, mapping tables (data cleansing), and interval-matching tables. Tables can be joined, concatenated, sampled and linked to external information such as other programs, bitmaps, URLs, etc.

In order to pull data from a data source, QlikView executes a load script. The load script defines the source databases and tables and fields that should be loaded into QlikView. In addition, you can calculate new variables and records using hundreds of functions available in the script. In order to help you create a load script, QlikView includes a wizard that will generate the script.

For simple applications, you simply need to point at the file you want to load; QlikView will automatically determine the type of file and generate the script required to load all of the data from the source. For more complex applications, it may be necessary to manually edit the script to load or combine sources in a non-standard way. QlikView's robust script language also includes syntax for flow control, e.g., loops, conditional processing, data cleansing and subroutines.

Wizards are available for advanced data transformation and inline table creation. Once the load script is generated, pushing the run button causes the script to execute. Within a few seconds, QlikView will extract the data from the source according to the instructions in the script and make the data available for use. The data can be reloaded at any time by simply pushing the reload button on the toolbar. QlikView Publisher then provides for automatic updates of applications. Incremental or partial reloads are also supported to add, update or replace only specified tables or append new data to an existing table.

Visual Basic Script and JavaScript Support

The QlikView automation interface offers application designers the ability to build complete, seamless applications based on the QlikView user interface. QlikView includes a complete Automation facility with support for Visual Basic Script (VBScript) and JavaScript. With this powerful, object-oriented programming language, it is possible for QlikView application designers to gain access to all of the objects and properties within an application.

Programmers can develop VBScript or JavaScript macros to add specific functionality to an application. Macros can be attached to button objects that a user must click to activate, or the macros can be attached to various QlikView events. For example, a macro can be automatically invoked whenever an application is opened, when the load script is executed, or when a selection is made in a list box.

Macros can also be used to add functionality to the load script execution. Macro functions can be invoked within the load script to perform specific processing, allowing access to each record as it is read from the source database.

In addition to macros within QlikView, the automation interface also exposes the QlikView application objects to external programs. Programmers can write programs in any language that supports utomation, like Visual Basic or C++, which manipulates the QlikView application.

Analysis Engine

As described earlier, QlikView's In-Memory Data Model forms the basis for every QlikView application. It holds all data loaded down on a transaction level, and is part of the QVW file (QlikView file format), which is loaded into RAM.

The QlikView platform is optimized to run on every available Windows platform (32 & 64-bit), and makes use of all available processing power and RAM for each specific hardware platform.

The Selection Engine processes the user "point-and-click" and returns the associated values to that query. It provides sub-second response times on queries made to the In-Memory Data Model.

The Chart & Table Engine handles the calculations and graphic display of the charts in the user interface. It calculates multiple "cubes" in real-time (one cube for each graph in the application), and promotes user selections directly in graphs.

Clients

Supported clients include an installed Windows EXE client that connects to the QlikView Server; an ActiveX component integrates other software. The platform also allows for an ActiveX plug-in for Microsoft Internet Explorer, AJAX zero-footprint client and is Java-client compatible with Mozilla based web browsers. An open interface enables automated integration with QlikView.

Security

The data in a QlikView application is often confidential and then you need to control the access to the data.

Authentication is any process by which you verify that someone is who they claim they are. QlikView can either let the Windows operating system do the authentication using the Windows log on, or prompt for a user ID and a password (different from the Windows user ID and password) or use the QlikView serial number as a simple authentication method.

Authorization is finding out if the person, once identified, is permitted to have the resource. QlikView can let the Windows operating system do the authorization, by allowing or disallowing a user, a group or a domain the access to the entire application. If a finer granularity is needed, e.g. the user is only allowed to see specific records or fields, the QlikView Publisher can be used to automate the creation of a set of applications, i.e. one application per user group.

As an alternative, QlikView can do the authorization itself. For this, an authorization table must be built into the script. Also here, a finer granularity (access on record or field level) can be achieved.
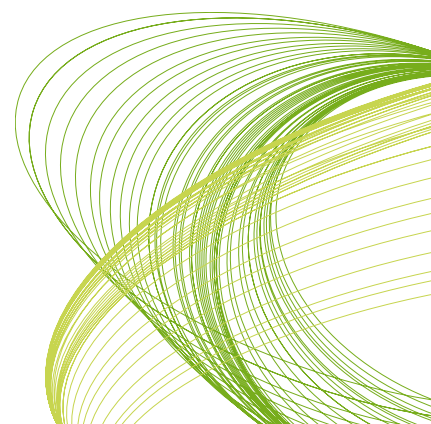
System Requirements

QlikView runs on any IBM PC compatible computer running Windows. QlikView takes full advantage of the system hardware, so faster processors and more processors directly affect application performance.

Available system RAM determines the maximum size of a QlikView application. Having more RAM available allows larger applications to be created, integrating data from more sources.

QlikView	32-bit	x64
Platform	Windows 2000 Windows 2000 Server Windows Server 2003 Windows XP Windows Vista	Windows XP Professional x64 Edition Windows Server 2003 x64 Edition
Processor	Pentium 4 or higher recommended	Intel and AMD x64 compatible processors
Memory	Depending on size of applications; 512 MB or more recommended	Depending on size of applications; 2 GB or higher recommended
Disk space	150 MB total required to install	150 MB total required to install
Security	Windows or custom authentication	Windows or custom authentication
Browser	MS Explorer 6.0 or higher[1]	

[1] When running QlikView Analyzer for IE, QlikView Analyzer Java, QlikView Analyzer AJAX ZFC

QlikView Server	32-bit	x64
Platform	Windows 2000 Server Windows 2000 Professional Windows XP Professional Windows Server 2003	Windows XP Professional x64 Edition Windows Server 2003 x64 Edition
Processor	Pentium 4 or higher recommended	Intel and AMD x64 compatible processors
Memory	Depending on size of applications; 1 GB or more recommended	Depending on size of applications; 4 GB or higher recommended
Disk space	200 MB total required to install	200 MB total required to install
Security	Windows or custom authentication	Windows or custom authentication
Web server	MS IIS [2]	MS IIS [2]

[2] Required for certain features in QlikView Clients

QlikView Publisher	32-bit	x64
Platform	Windows 2000 Server Windows XP Professional [3] Windows Server 2003	Windows Server 2003 x64 Edition Windows XP Professional x64 Edition [3]
Processor	Pentium 4 or higher recommended	Intel and AMD x64 compatible processors
Memory	Depending on size of applications; 512 MB or higher recommended	Depending on size of applications; 2 GB or higher recommended
Disk space	200 MB total required to install	200 MB total required to install
Security	Windows or custom authentication	Windows or custom authentication
Database	SQL Server 2000 [4], SQL Server 2005 [4], Native XML	SQL Server 2000 [4], SQL Server 2005 [4], Native XML
Web server	MS IIS 5 or higher	MS IIS 6
.NET	2.0.50727	2.0.50727
Browser	Internet Explorer 6	Internet Explorer 6

[3] For development only. For larger loads, a server is recommended.
[4] Optional

The QlikView interface is designed to provide a perfect data overview in multiple dimensions – simplifying analysis and reporting for everyone. It presents data intuitively, allowing users to question anything and everything, from all types of objects (e.g., list boxes, graphs, tables) and to any aspect of the underlying data – regardless of where the data is located in a hierarchy.

QlikView Application
and User Interface

Figure 6: QlikView's Visually Interactive User Interface
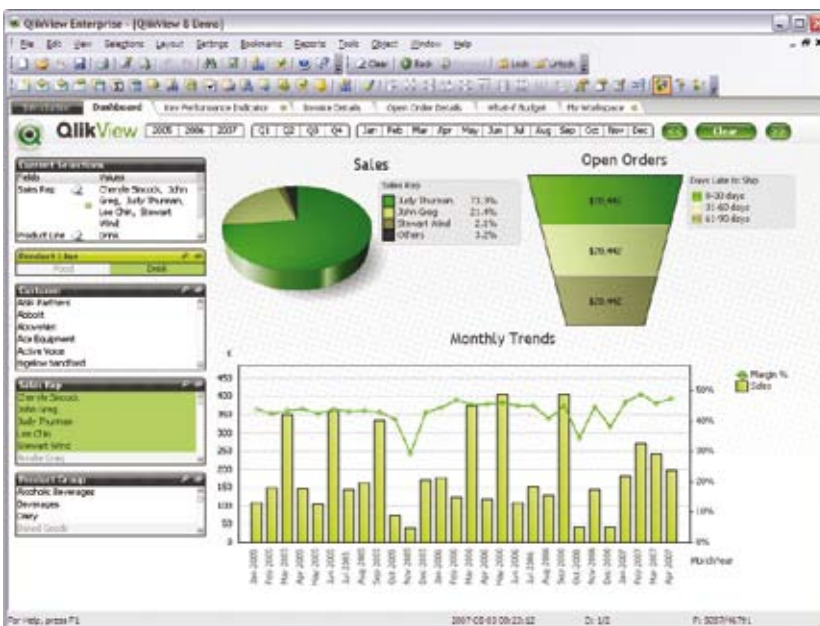
## Key Elements of the User Interface

Sheets & Tabs
In QlikView, analysis is made on sheets navigated through tabs (similar to Excel). Each sheet can hold several sheet objects (list boxes, graphs, tables etc) to analyze the underlying data model. All sheets are interconnected, meaning that selections made on one sheet affect all other objects on all other sheets.

List Box
The basic building block of a QlikView application is the list box. A list box is a movable, resizable object that presents the data taken from a single column of a table. Rather than listing the duplicate values, only unique values are presented. If desired, the number of occurrences of each distinct value can also be listed.

Multi Box
The multi box can hold several fields in a single object. Selections can be made through drop-down lists by clicking or text search and select. The multi box displays values only in a single selected mode.
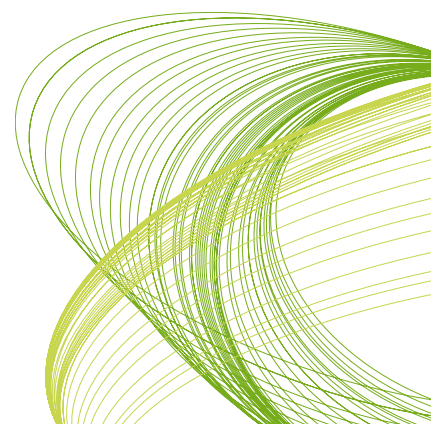
Charts & Gauges

In QlikView, the results of a selection or query can be displayed in a graph. Typically, a graph holds one or more expressions which are recalculated each time a selection is made. The result can be displayed as a bar chart, line chart, heat chart, grid chart, scatter chart, or as speedometer or gauge. All graphs are fully interactive, which means that you can make selections or queries directly by point-and-click or by "painting" the area of interest.

Tables

Just as with graphical representation of data (in graphs), the result of an analysis can be displayed in a table. QlikView provides the ability to display data in powerful Pivot tables and Straight tables. These tables are fully interactive, which means that you can make selections directly in the tables or by drop down selections in the graph dimensions. Using a table box, QlikView can display any combination of fields in a single object, regardless of what source database table they came from. This feature is useful when providing listings of any kind. The table box can be sorted by any field or combination.

Reports & Send to Excel

QlikView has an integrated report editor for ease-of-use of application specific reports. The reports are dynamically updated as the user makes selections. Power users can also easily create reports by a simple drag-and-drop procedure. All data displayed in the GUI is ready to be exported at any time to Excel or other applications by a simple click of a button.

User Navigation and Analysis

Point-and-Click Queries

Asking and answering questions is a simple matter of point and click. The user forms a query in QlikView simply by clicking the mouse on a field value or other item of interest. In a list box, the user clicks on one or more values of interest to select them. QlikView immediately responds to the mouse click and updates all objects displayed on the current sheet.

QlikView uses colors to allow the user to interpret the results of a query (a mouse click). The values that the user actually clicks are highlighted in green and are called selected values. The values that are associated with the clicked values remain white and are called optional values. Any values that are not associated with the clicked values are called excluded values and are dimmed with a gray background.

Multiple Sort Options

Since each field of data can be displayed in its own list box, it makes sense that you would want to sort each list box independently of all others. When you are scrolling through a list box, you want the values to appear in some sorted order appropriate to that field. QlikView allows you to sort each list box independently and according to multiple sort specifications.

One or more of the following algorithms can apply to each list box in either ascending or descending order:

|	
State:	Selected and optional values can be sorted from the top or bottom of the list box
Expression:	Values are sorted by the result of evaluating any entered expression
Frequency:	Values are sorted by frequency of occurrence
Numeric Value:	Values are sorted according to their numeric value
Text:	Values are sorted alphabetically
Load Order:	Values are sorted according to the way they occurred in the original source database

In addition, the same field (column) can be displayed in multiple list boxes – each with its own sort order.

Powerful Searching

Remember that a list box represents the distinct values found in a specific field in one or more tables. By displaying only distinct values, the number of values presented is reduced to a minimum. However, the number of values listed can still be hundreds of thousands or more. Finding a specific value would be difficult if you had to scroll through the complete list.

Fortunately, QlikView allows you to search through the list as simply and quickly as typing on the keyboard. Select any list box, or open a multi box or drop down list, and start typing. QlikView immediately begins searching through the list to find values matching your criteria. Single character and multi-character wildcards are supported, as well as greater than and less than symbols to enable searching for numeric and date ranges.

As QlikView locates values matching the criteria typed so far, those values are pulled together to the top of the list box. Values that do not match the search criteria are removed from view. Once the specific value or values you are searching for come into view you can either click on the values with the mouse to select them or press the enter key to select all matching values. QlikView's normal color-coding is then applied to the values.
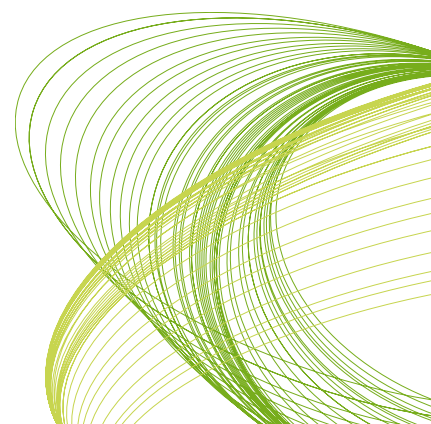
Rapid Application Design and Deployment

Simple applications can be created within just a few minutes using QlikView's wizards. More complex applications integrating data from various sources and displaying trend analysis charts and pivot tables may take a little bit longer.

The best way to understand how simple it is to create and use a QlikView application is to step through the process involved:

Step 1: Locate the Data Source

The first step in creating an application in QlikView is to determine what data you wish to load. While it is possible to include inline data in the QlikView load script, application data will almost always come from an existing file, spreadsheet or database. You may load data from a single source file or data-base, or you may load and integrate data from many different sources at the same time.

The source file will typically be arranged with each record of the file containing one record of data. However, QlikView can work with data in practically any format, including generic databases, cross-tables, hierarchical databases, multi-dimensional databases, etc. The first row may or may not contain field labels, although you can always choose to set or change the labels in the wizard or in the script. If the data will come from a text file, each file will typically be treated as a single table. When working with spreadsheets, each tabbed sheet will be treated as a table.

If you load data from multiple files or tables, QlikView will automatically associate fields with the same name. If tables should be associated and the association fields do not have the same name, you need to rename the fields in the load script. If fields in different tables have the same name but should not be associated, you need to rename those fields in the load script to break the association.

Step 2: Create the Load Script

Once the source data has been determined, a load script must be created to copy the data from the data source into QlikView's associative database. Creating the load script is simplified by the use of wizards that construct script statements for supported file types.

If the source data is contained in a text file or Microsoft Excel spreadsheet, the "typed file" wizard will guide you through a few simple steps to create load script statements. You will use the wizards for each table that must be read. With just a few dialogs, you will specify the file name, the delimiter, the fields to read, and the names of any fields. After completing the specification for a table or file, the wizard will add a load statement to the script. When working with ODBC or OLEDB data sources, there are two wizards that help you create a connection to the database and build a SQL Select statement to read the database.

Step 3: Execute the Load Script

After the load script is complete, the script must be executed either by using the "Run" button in the Edit Script dialog, or by selecting "Reload," available on both the toolbar and the File menu. During the load process, QlikView examines each statement in the load script and processes it in sequential order. At the completion of the load script, a copy of all of the data referenced in the load script is loaded and available in the QlikView application.

Step 4: Place Objects on a Sheet

In order to use the data in the QlikView application, you must place list boxes or other objects on one or more sheets. The actual objects that should be used and how they should be grouped into sheets depends on the specific application.

Typically, you should start by placing the main fields as list boxes. Using the "Select Fields" dialog box, one or more fields can be quickly added to the current sheet using the default list box format. Once the list boxes are created, their individual properties can be adjusted to add frequency counts, change fonts, change borders, etc. They can also be rearranged on the sheet by simply dragging each list box to its desired location.

Any or all fields loaded by the script can be displayed on the same sheet. If fields were loaded from different tables, they will be automatically associated together and respond to clicks as if all fields belong to one large table.

Step 5: Start Using the Application

As soon as the first object is created on a sheet, the application is available for use. All objects are automatically associated together, and clicking in any object initiates a query.

Step 6: Add More Sheets and Objects as Required

Finally, continue to add and arrange objects on sheets until the application achieves the functionality desired. You may wish to add more customization to the load script by taking advantage of QlikView's "Expression Engine," or you may wish to add macros to automate certain actions.

Objects can be copied or moved to other sheets by dragging the object and dropping it on the sheet tab of another sheet. Layout controls on the view menu allow easy alignment and spacing of sheet objects to help create an orderly appearance. In addition, wallpaper, pictures, and text can be placed on the sheet to give the application a polished and professional look.

Within just a few minutes, a complete, working application can be created. The application can be distributed to other users who can add customization to the layout – without any need to access the original data source. For example, users can add their own sheets, pivot tables and charts (or any other object) to make the application suit their personal working style.
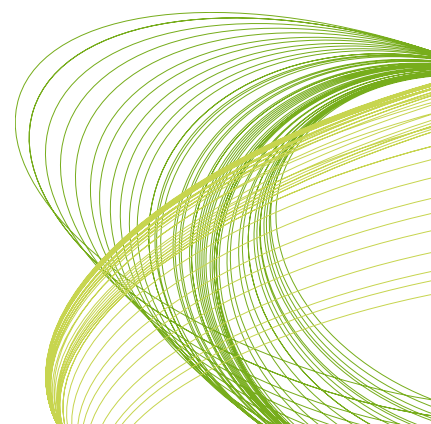
QlikView Deployment

QlikView can be deployed in many ways to meet the specific needs of different organizations; handling even the most complex organizational structures and complicated application needs. QlikView Server is the heart of the solution, providing security. QlikView Publisher then administers the user profiles to distribute analysis and reporting appropriately.

Figure 7: QlikView Deployment Scenario
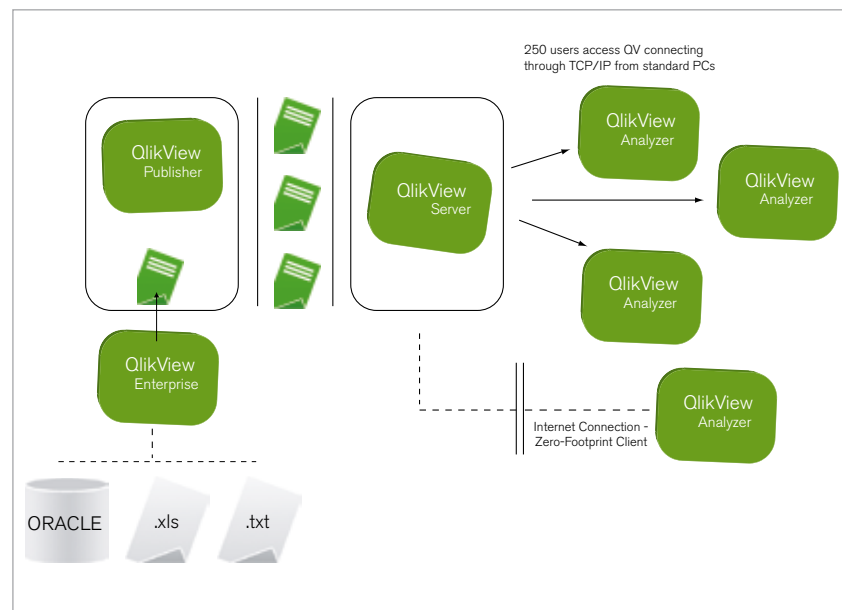
In a typical deployment scenario with a server-based 250 user (Analyzer) BI platform, as shown above, QlikView Enterprise is used for developing applications while data is loaded from various data sources (Oracle, Excel, spreadsheets, text files, etc.). QlikView Publisher makes sure applications are refreshed with the right data following a strict schedule. Applications are distributed by QlikView Publisher, based on internal distribution rules using users and groups in Active Directory, making sure that every user in the organization gets the right analysis at the right time. Users connect to QlikView Server for business analysis using QlikView Analyzer on local PCs or offsite via the Internet through a zero-footprint client. The same point-and-click approach works for those managing deployment – it requires no training, making deployment fast.

QlikView in Action

"Everybody's on the same page talking from the same numbers. Our President says, 'Using QlikView is now a way of life in our company."

Martina Latimer, Manager of Business Intelligence, Blyth HomeScents International

"We can see how the business is doing today – right now. We do it on the fly and it doesn't take two or three days."

Jacob Hoffmann-Petersen, IT Manager, IDG Denmark

Thousands of companies in virtually every industry around the world relay on QlikView analysis for better business performance, allowing them to be more proactive, more efficient and able to respond to issues faster. QlikView supports a broad array of solutions throughout the organization across the major functional areas from sales, marketing, service and Web to supply chain and operations to finance and human resources to R&D and IT. A sampling of QlikView solutions are highlighted below for several of the functional areas.

Multidimensional Sales Analysis Improves Bottom-Line Results

With QlikView, companies can analyze performance in unlimited dimensions – by rep, customer, region, product, group, for greater profitability.

– Determine true cost of sales
– Track commissions and incentive programs
– Pinpoint underperforming products
– Perform customer-specific sales analysis and determine customer-by-customer profitability
– Conduct predictive analyses on pricing, bundled products and territories

Better Supply Chain Performance

QlikView analysis keeps supply chains flowing smoothly, pinpointing potential delays before they become problems. As a result, companies have cut costs from raw material suppliers, lowered excess inventory and improved on-time delivery, among other bottom-line benefits.

– Identify and solve problems proactively in your supply chain, from supplier deliveries, production schedules to warehousing that keep operations from flowing smoothly
– Determine true product costs with analysis of every aspect, enabling you to improve margins or offer discounts to key customers
– Get the best pricing and highest service levels from your suppliers with comparative performance analysis

Transparent, Visual Reporting on Financial Performance – In an Instant
QlikView provides graphical KPI dashboards for business improvement
measurement throughout the organization.

- Financial analysis across unlimited dimensions – by customer, product,
  product line, industry segment, geography, business unit
- Automated, consolidated financial reporting – from ERP or custom
  applications, Excel™ spreadsheets, or other sources – in an instant
- Budget summaries by geography, department or overall, including
  actuals and accruals in both local and corporate reporting currencies
- Detailed profitability analysis
- What-if scenarios and predictive analysis for proactive planning
- Streamlined SOX and Basel II compliance reporting – with a clear
  audit trail across multiple data sources

Proactive HR Management
QlikView helps HR executives match the right skills to the right jobs, manage
talent and ensure that individual and group performance meet Key Perfor-
mance Indicators (KPIs) and align with overall objectives.

QlikView applications can:
- Balance shift schedules
- Measure recruiting performance
- Map skill requirements to positions
- Analyze retention incentives and effectiveness
- Conduct what-if analysis on staffing and scenarios
- Assess training programs, from profile attendance to evaluations
- Analyze compensation and payroll rates
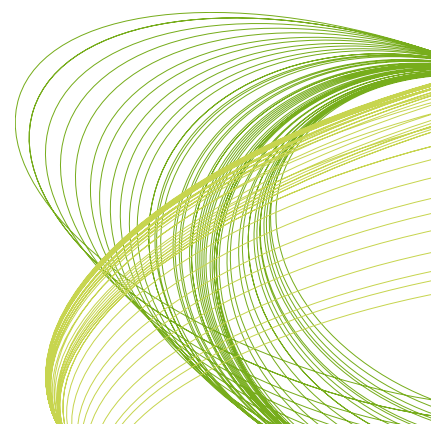
Summary

QlikView offers a complete analysis solution – dashboards and alerts, multi-dimensional analyses, slice-and-dice of data – without the limitations, cost or complexity of traditional OLAP cubes. Solutions can be deployed in days, users can be trained in minutes, and end users get answers in seconds – not hours – to refine their decisions.

QlikView's next generation approach is completely aligned with – and ahead of – the industry with fast, powerful and affordable analysis for everyone in the organization. QlikView is able to analyze massive amounts of data at unprecedented speed because of its in-memory data model design. As a result of this design, users get sub-second response times on queries and calculations and the ability to process massive datasets; companies can deploy to large user populations quickly and affordably.

Business Intelligence should provide not only past and current business snapshots, but also allow for predictive analysis, giving a picture of where your business can be headed. [7] Moving business intelligence from tactical, departmentalized use to strategic, enterprise-wide use involves the following:

Figure 8: Enabling Strategic BI with QlikView

Tactical BI	Strategic BI
Single function	Cross-function, department and organization
Limited number of tech-savvy "power users"	Wide end-user function supporting hundreds, if not thousands of users
Passive, driven by reports	Active, driven by exceptions and rules
Client/server deployment	Web deployment, through portals and with wireless support
Historical analysis	"Appropriate time", with forecasting capabilities
Product and tools based	Solution based

[7] *Janet Kersner. (June 12, 2006). "Connection the Dots", CFO Europe Magaxine, Website: http://www.cfo.com/article.cfm/7001368/c_2984335/?f=archives*

QlikView provides the capabilities that traditionally required a complex and costly suite of products – all in a single, affordable and flexible solution – today. Thousands of companies around the world are reaping bottom-line benefits from QlikView:

Strategic Business Benefits
– Make better decisions faster
– Improve monthly, quarterly, annual and long-term planning direction
– Reduce the cost of – and increase confidence – in compliance reporting
– Improve business process and confidence in business controls
– Consistent internal reporting and "vocabulary"
– More knowledgeable and empowered workforce
– More proactive, agile and responsive organization

Tactical and Technical Benefits
– More efficient processing resources
– Faster response times – even with massive data volumes
– Lower Total Cost of Ownership
– Free IT resources from reporting and user support to focus on other critical activities
– Faster initial and ongoing deployments

QlikView in-memory analysis and reporting is simplifying analysis for everyone and has clearly demonstrated its affordability and value to organizations across industries for solving their performance and information challenges.

QlikView