

The 5 Styles of Business Intelligence:

INDUSTRIAL-STRENGTH BUSINESS INTELLIGENCE

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A White Paper Prepared by MicroStrategy, Inc.

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1

EXECUTIVE SUMMARY

The purpose of this paper is to provide a framework for understanding the diverse range of business intelligence (BI) functionality that has evolved in the market over the past 15 years. It is also intended to show that there is a fundamental shortcoming in most BI tools today because they cannot support the full range of BI functionality within a single architecture – leading to excessive costs, excessive delays and excessive user dissatisfaction. Finally, this paper describes the MicroStrategy architecture as being the only BI architecture capable of delivering all of the functionality requirements within a single architecture.

This paper looks at the historical development of BI applications and BI technology, and concludes that five common Styles of BI have evolved during the past decade – each style representing a certain characteristic usage and function by end users. These 5 Styles of BI are:

1. **Enterprise Reporting** – Broadly deployed pixel-perfect report formats for operational reporting and scorecards/dashboards targeted at information consumers and executives.
2. **Cube Analysis** – OLAP slice-and-dice analysis of limited data sets, targeted at managers and others who need a safe and simple environment for basic data exploration within a limited range of data.
3. **Ad Hoc Query and Analysis** – Full investigative query into all data, as well as automated slice-and-dice OLAP analysis of the entire database – down to the transaction level of detail if necessary. Targeted at information explorers and power users.
4. **Statistical Analysis and Data Mining** – Full mathematical, financial, and statistical treatment of data for purposes of correlation analysis, trend analysis, financial analysis and projections. Targeted at the professional information analysts.
5. **Alerting and Report Delivery** – Proactive report delivery and alerting to very large populations based on schedules or event triggers in the database. Targeted at very large user populations of information consumers, both internal and external to the enterprise.

This paper shows that most BI technologies today can deliver only a single Style of BI. It shows that companies are increasingly dissatisfied with this limitation because it perpetuates a multiplicity of BI technologies within the enterprise that increases costs of ownership, decreases user acceptance and limits the richness of each BI application.

This paper shows that enterprises today need a BI technology that can support any or all of the 5 Styles of BI in any combination for any given BI application. Moreover, it argues that the only good architecture for delivering all 5 Styles of BI is one where each Style of BI can be:

1. **Mixed-and-matched** seamlessly for users, where the addition of each new BI Style adds functionality to the users' existing reports
2. Expressed through a **single unified user interface** to maximize ease of use and user acceptance
3. Delivered on top of a **single integrated backplane** that unifies the metadata, security and user profiles, ensuring a single version of the truth throughout the enterprise and thus minimizing administration and maintenance efforts by IT

Finally, it shows that MicroStrategy delivers each Style of BI uniquely well and that only the MicroStrategy architecture can deliver all 5 Styles of BI on a single unified backplane and through a single unified user interface. It shows that all other BI technologies are fragmented along Styles of BI, such that they impose different user interfaces, different metadata and different security for each Style of BI.

2

THE 5 STYLES OF BUSINESS INTELLIGENCE

Since the early 1990s, BI applications have evolved dramatically and in many directions as companies' access to, and appetite for, information grew exponentially. From operational "green-bar" reports generated by mainframes, to statistical modeling of marketing campaigns, to multi-dimensional OLAP environments for analysts, to dashboards and scorecards for executives – companies began to demand more ways to report on and analyze data. The dramatic expansion of data warehousing combined with the widespread adoption of enterprise applications, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), and the overall increase in computer literacy, fueled this exponential demand for BI reporting and analysis applications.

During this formative period, companies actively discovered many new ways to use their data assets for decision support, operational reporting and process optimization. And during this era of invention, BI technology vendors reacted the way software vendors always react to new evolving markets – that is, by building niche software to implement each new pattern of application that companies invented. These patterns of applications resulted in software products centered exclusively on one Style of BI, as follows:

1. **Enterprise Reporting** – Report writers were used to generate highly formatted static reports destined for broad distribution to many people.
2. **Cube Analysis** – Cube-based BI tools were used to provide simple slice-and-dice analytical capabilities to business managers.
3. **Ad Hoc Query and Analysis** – Relational OLAP tools were used to allow power users to query the database for any answer, slice-and-dice the entire database and surf down to the lowest level of transactional information.
4. **Statistical Analysis and Data Mining** – Statistical and data mining tools were used to perform predictive modeling or to discover the cause-and-effect correlation between two metrics.
5. **Report Delivery and Alerting** – Report Distribution engines were used to send full reports or alerts to large user populations based on subscriptions, schedules or threshold events in the databases.

At this point in time, most leading enterprises have purchased many different BI tool sets from many different vendors – with each tool targeted at a new BI application and each tool delivering user functionality focused on only one of the Styles of BI.

One way to look at these different Styles of BI is to place them in a two-dimensional space (Fig. 1) where the vertical axes represents the sophistication and interactivity of the analytical processes and the horizontal axis represents scale, or the size of the user population. We can then locate each of the 5 Styles of BI in a region on the grid, as we see in the figure below.

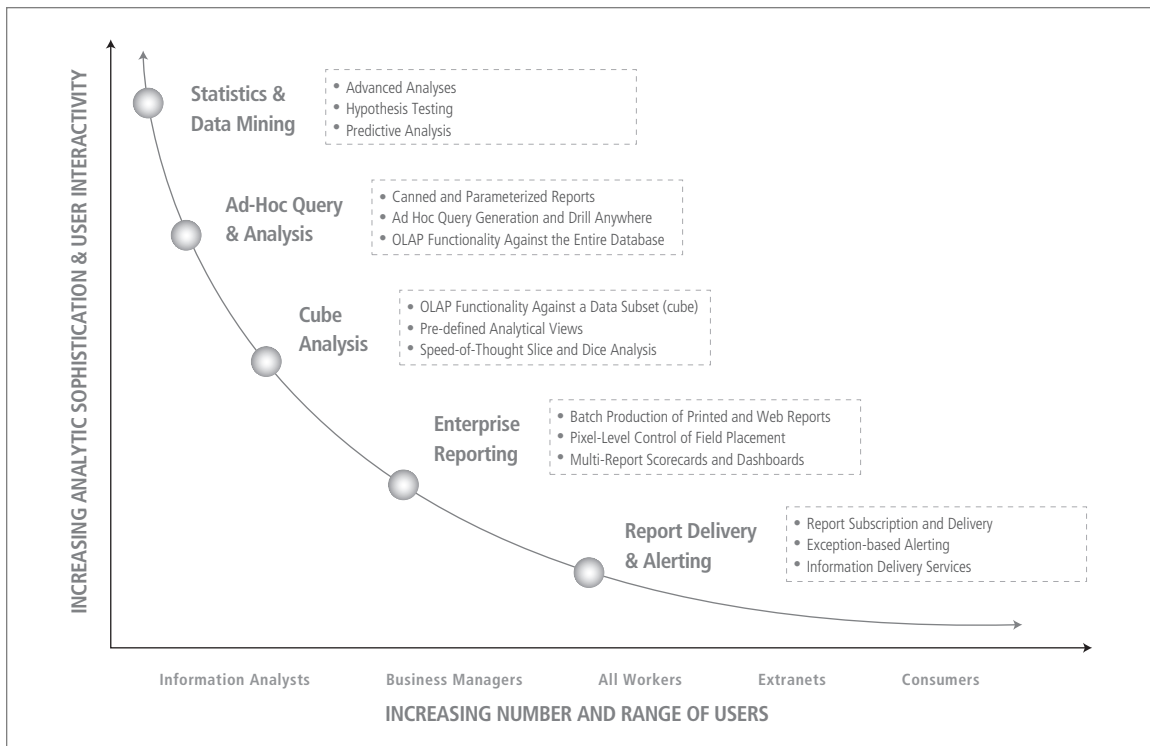


Figure 1 – The 5 Styles of Business Intelligence have evolved to support different needs, from advanced professional analysis to basic information consumption.

The most sophisticated and interactive Styles of BI are used by relatively small groups of users consisting of information analysts and power users, for whom data and analysis are their primary jobs. Less interactive Styles of BI deliver basic data and results that are applicable to very large user populations ranging from senior executives all the way to staff personnel.

Leading organizations have recognized the benefits of putting information into the hands of all their employees, regardless of job title or function. Only the MicroStrategy architecture can deliver all 5 Styles of BI functionality to each and every user within an enterprise, offering different functionality levels within the 5 Styles of BI tailored for each user.

2.1 The 5 Styles of BI In An Enterprise Application Scenario

It is generally accepted now that from the CEO to the support staff, every employee of leading organizations analyzes business data to some degree, in some fashion. Their analyses may be deliberate and exploratory, they may be triggered automatically by threshold conditions or they may even be so embedded in everyday systems that their existence as BI per se may not even be recognized. One thing is clear: successful organizations make maximum use of their data assets through BI technology.

In the following scenario, a typical set of analyses and responses are used to demonstrate the 5 Styles of BI in practice.

BI Style 1: Enterprise Reporting

When an enterprise wishes to distribute standard operational reports or financial reports to all stakeholders in the organization, Enterprise Reporting is used. Since the 1950s, corporations have found clear returns on their investment in operational and financial reporting. Consequently, Enterprise Reporting is the most widespread Style of BI – ranging from its earliest adoption as mainframe green-and-white banded paper reports to today's web-based reports.

Consider the following scenario. A store manager receives Store Performance reports generated weekly by the Report Distribution engine. After a review of one such weekly report on store sales, the store manager notices that sales for computer peripherals have dropped off significantly from previous weeks. She clicks on her report and immediately drills to another enterprise report, which shows her that the 3 best selling hard drives are surprisingly underperforming

BI Style 2: Cube Analysis

Cube Analysis is the Style of BI ideal for basic analysis that can be anticipated in advance. The analysis of sales by region for certain time periods, and the analysis of sales by product and by salesperson, for instance, could be useful to store managers looking for some underlying details on performance.

In our scenario, the store manager digs deeper into the issue by running one of several analysis cubes that have been pre-built for the store managers. Analysis cubes provide people with a simple and safe environment that lets novice BI users easily conduct first-order analyses to try to uncover root causes. This particular store manager's analysis cube allows her to compare her store's sales results against the sales plan, against sales results at other stores like hers, and against previous years' seasonal patterns.

After flipping through various views of the data in her analysis cube, several things become apparent. The first is that most stores seem to be experiencing this same sudden slowdown in sales. The second is that this trend will quickly prevent her from achieving her revenue goals for this product category. And third, this downturn is inconsistent with seasonal sales patterns from the last 2 years for this kind of product. She concludes that there is a serious problem here, and that it is a corporate problem not unique to her store.

She forwards a link to this analysis cube to a buyer at HQ, so they can see exactly what she has seen and delve deeper into the problem.

BI Style 3: Ad Hoc Query and Analysis

Ad Hoc Query and Analysis is the Style of BI that enables true investigative analysis of enterprise data, down to the transaction level of detail.

The buyer at HQ accesses the analysis cube but cannot determine what is happening based solely on pre-defined comparisons within the cube. The buyer needs to probe many more areas of the database to determine what is going on, and uses Ad Hoc Query and Analysis techniques to accomplish this.

In our scenario, the buyer runs a parameterized, or prompted, report that lets him create an ad hoc report simply by answering some initial questions. His prompt answers automatically generate a report of inventory data for North America for the previous 2 months for the specific SKUs in question.

He sees that there has been a steady stream of shipments from the warehouses to the stores, but also that a stoppage in warehouse replenishment has caused a depletion of inventory in the warehouses. He concludes that the problem lies somewhere further back in the supply chain. Next, he drills down from the inventory report to a shipping report that indicates all seaborne shipments from Taiwan have been delayed, affecting the SKUs in question, as well as some other SKUs. He determines that the other SKUs likewise will soon experience a shortfall in sales.

He informs the VP of Sales and all store managers of the results of his analysis, and sends the reports to the marketing department to determine the significance of the shipment delays on the company's revenue and profits for the quarter.

BI Style 4: Statistics and Data Mining

Statistics & Data Mining is the Style of BI used to uncover subtle relationships (e.g. price elasticity) and forecast projections (e.g. sales trends), using set theory techniques, statistical treatment and other advanced mathematical functions.

In our scenario, an analyst in the marketing department builds a model of the product line's revenue and gross margins for the quarter as a function of shipment times, pricing and demand. After estimating the financial impact of the delayed shipments, the analyst recommends raising the price on the remaining items in stock to help cover the lost margins. She also recommends some new promotional spending to substitute alternative hard drives through a combination of in-store marketing and advertising.

BI Style 5: Report Delivery & Alerting

A Report Delivery and Alerting engine allows enterprises to distribute vast numbers of reports or messages on a proactive and centralized basis, as well as allowing users to self-subscribe to report distributions.

Report distribution can be initiated on a scheduled basis, as well as on an event-triggered basis, such as a metric's value falling below a target threshold.

In our scenario, a task force continuously monitors the progress of new sales programs by subscribing to a distribution service that continuously measures sales performance of relevant SKUs, their margin performance and the costs for the new promotions. The service also continuously monitors the inventory levels in the warehouses and alerts all stakeholders as soon as the shipment delays are over, signaling that pricing and promotion should return to normal. Together, the team is able to make intelligent decisions, respond quickly to changing events, and preserve the company's exceptional level of performance.

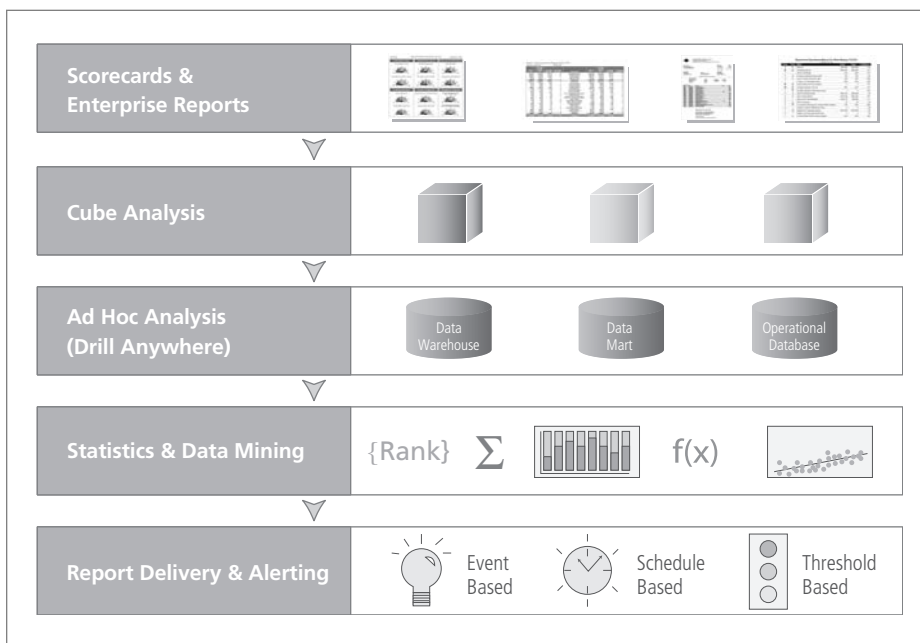


Figure 2 – Only the MicroStrategy architecture allows users to move seamlessly from basic operational reports and scorecards, to ever increasing levels of analysis and back again – all through a single unified user interface.

2.2 Industrial-Strength BI Technology Is Needed To Meet Companies' Growing Requirements for Business Intelligence

BI Tools Have Proliferated Out of Control within Companies

Today, most large companies have over a dozen different BI technologies installed and in use somewhere in their organizations. There are two reasons for this gross proliferation of diverse technologies. The first is because the vast majority of BI tools only support a single Style of BI at a time. If a company needed Ad Hoc Query and Analysis capabilities as well as Enterprise Reporting capabilities, then at least two tools would have been purchased. The second reason is because the vast majority of BI technology was designed in such a way that it could only support small department-scale applications. As a result, BI

applications were deployed in isolation and ultimately individual departments felt empowered to choose whatever BI technology they wanted.

Departmental BI Technology Will Be Replaced by Industrial-Strength BI Technology

Most BI technology vendors reacted to this purchasing behavior by developing departmental BI products – that is, BI technology focused on a single Style of BI, with limited user scalability, limited data scalability and operational characteristics more attuned to casual small-scale operation, rather than the 24x7 mission critical operation expected of real enterprise-caliber systems. (Fig. 3)

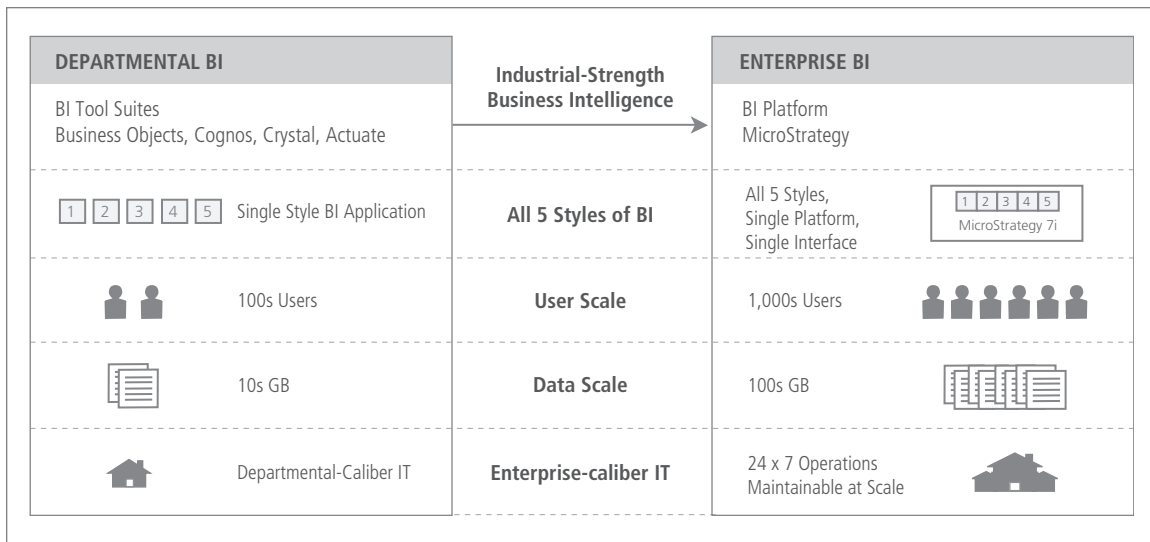


Figure 3 – Only the MicroStrategy architecture was completely rebuilt as an industrial-strength BI architecture designed specifically to serve enterprise BI requirements.

The end result of departmental BI tool limitations and departmental BI purchasing has been the massive proliferation of islands of BI that we see today. We’ve seen this kind of proliferation of isolated IT islands before. We saw it with departmental email systems, with departmental PC/Macintosh purchases, with departmental client-server applications, with departmental office automation systems and with departmental web sites. In all of these prior cases, the departmental aspirations gave way to enterprise aspirations, and the departmental technology gave way to industrial-strength technology. The same will be true of BI. In technology-forward companies, departmental BI tools are giving way to the only industrial-strength BI platform – MicroStrategy is the only BI architecture that delivers all 5 Styles of BI.

The Problem with Multiple BI Tools for Different Styles of BI

There are five macro forces that are obsolescing the “strategy” of isolated departmental islands of BI and the use of disparate departmental BI tools.

Problem 1.

Enterprise BI Applications Need to Access More Data and Support More Users – Departmental BI Lacks User and Data Scalability. Most companies have captured the low-hanging

ROI fruit with their current array of departmental BI applications. Based on the almost universal success of these applications, companies are now emboldened to take it to the next level. And that means delivering much richer reports and analysis, from much larger pools of data and delivered to many more users.

Unfortunately, departmental BI tools today cannot scale to these new levels (Fig. 4). The very nature of their underlying architecture prohibits them from analyzing terabytes of data and delivering to expanding user bases.

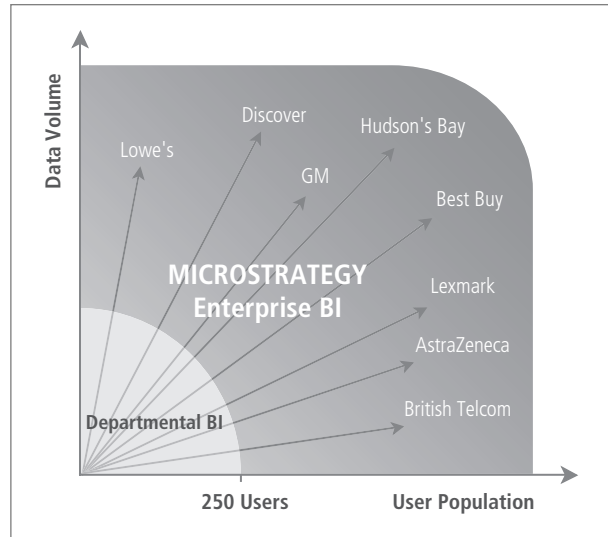


Figure 4 – Companies are refocusing their aspirations from departmental BI applications in favor of achieving greater impact with enterprise BI applications.

Companies need an industrial-strength BI platform designed for scale to replace departmental BI tools designed solely for interface functionality. MicroStrategy is the only server-centric BI architecture that can analyze terabytes of data and support hundreds of thousands of users easily.

Problem 2.

Inconsistent Versions of the Truth Are Propagating Through the Enterprise – Multiple Islands of BI Result In Multiple Inconsistent Metadata Repositories. Multiple independent islands of departmental BI applications work fine when the number of applications is small. When there are few applications, there is little overlap in analytical or reporting domains; inconsistencies in data definitions, in metric usage and business model are not readily evident. However when the number of BI applications achieves a certain critical mass within the enterprise, there is an inevitable overlap in analytical and reporting domains. It becomes inevitable that multiple reports from multiple independent BI applications present inconsistent information, preventing a consistent version of the truth. As the number of applications increases, these inconsistencies undermine the integrity of all the BI applications.

Companies need a BI technology that is built on one central, unified metadata that ensures consistency across hundreds of BI applications and the thousands of metrics, attributes and filters that make them up. Only the MicroStrategy architecture can deliver a single metadata across all 5 Styles of BI.

Problem 3.

Users Are Increasingly Dissatisfied About Being Forced to Use Multiple BI Tools – Multiple User Interfaces Are Problematic. When the number of BI applications is few, any given person only uses one of those applications, and hence only uses the one BI technology associated with that application. As the number of BI applications increases, more and more people will be accessing multiple BI applications, and hence using multiple different BI user interfaces to view reports and manipulate those reports. This means that BI users need to learn different ways to do everything, including such common

actions as finding reports, running reports, scheduling reports, editing reports, saving reports, sharing reports, answering prompts, sorting the data and pivoting the data. With two different tools, users will face challenges. With three different tools, users will be reluctant or unable to use the multiple applications. With four or five different tools, this becomes a valid reason for user rebellion. Nonetheless, this is the situation in which most companies are now finding themselves. With the MicroStrategy architecture, all Styles of BI use the same user interface with consistent paradigms for all user actions. There is no additional user training required as people expand their horizons to use more and more Styles of BI.

Problem 4.

Enterprise BI Applications Require a Richer User Experience Encompassing Multiple Styles of Business Intelligence – Single-purpose BI Tools Are Unable to Mix-and-Match Styles of BI.

Most departmental BI applications employ a single Style of BI. Enterprise Reporting applications are focused on the distribution of static, data-packed reports. Cube-based BI applications are focused on OLAP slicing-and-dicing of small data sets as with Cube Analysis. Other applications provide free form analysis of the entire database as with Ad Hoc Reporting and Analysis. However, the scenario described in this chapter shows that there is really a natural user flow starting with information presentation, to problem isolation, to full investigation, to advanced analysis, to proactive tracking and alerting.

Technical boundaries that isolate the Styles of BI are purely artifacts of single purpose Style of BI software technology, and have nothing to do with user preferences or natural application boundaries. Only the MicroStrategy BI architecture allows companies to deploy any or all Styles of BI – exactly what they need, efficiently when they need it and precisely to the appropriate users.

Problem 5.

IT Organizations Cannot Afford the Excessive Cost of Managing Multiple BI Technologies –Disparate BI Technologies for Multiple BI Applications Are Burdensome. Finally, IT organizations suffer excessive redundant costs in managing many diverse BI technologies. With multiple BI tools, companies need to train people in the development and operational intricacies of each BI technology. Companies must establish technical support teams to specialize in each capability. Companies must manage contracts with each BI vendor. Companies must go to conferences, user groups and support forums for each BI vendor. Companies must coordinate new version upgrades with their versions of database software, server operating systems, workstation operating systems, browsers, web servers and firewalls. Companies must manually synchronize metadata overlaps between multiple BI technologies – such as security, business definitions, metric definitions and user profiles.

Only with a single BI architecture can a company avoid all of these redundant costs and efforts. Only the MicroStrategy architecture can deliver all 5 Styles of BI with the enterprise scale of data and user populations, in turn freeing up time, effort and money.

The Ideal Architecture for Delivering All 5 Styles of BI

The ideal architecture for delivering all 5 Styles of BI is one that can deliver:

1. **Any or all Styles of BI which can be mixed-and-matched** seamlessly for the end users, where the addition of each new BI Style adds functionality to the users' existing reports
2. All expressed through a **single unified user interface** to maximize ease of use and user acceptance
3. All delivered on top of a **single integrated backplane** that unifies the metadata, security and user profiles, ensuring a single version of the truth throughout the enterprise and thus minimizing administration and maintenance efforts by IT

The MicroStrategy architecture was completely rebuilt from the ground up from 1996 through 2000 to achieve precisely this range of flexibility, along with unparalleled scalability – all the things that companies need for industrial-strength BI.

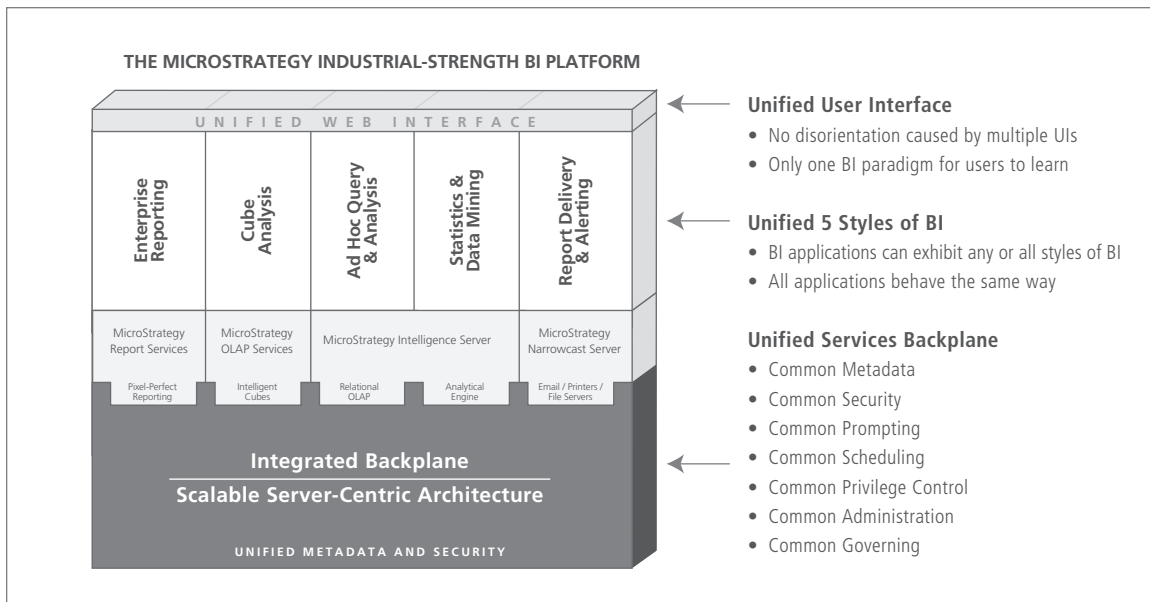


Figure 5 – The MicroStrategy architecture delivers any or all Styles of BI through a unified user interface and leverages an integrated backplane of unified services.

Other BI vendors may appear to offer integrated products because they are bundled under common names and marketing umbrellas. These product collections are cleverly marketed as integrated suites, which mislead organizations into believing that they are implementing a single architecture. Only later do the companies learn that they have purchased a set of disjointed tools of mainly piecemeal acquisitions, which are in fact just “integrated” through a patchwork of bridges, gateways and portals.

The MicroStrategy architecture stands alone in the BI market space as the one integrated architecture, built from the ground up to deliver all 5 Styles of BI with the level of scalability and manageability suitable for enterprise BI applications and capabilities.

3

ENTERPRISE REPORTING

Enterprise Reporting is designed for information consumers; individuals at all organizational levels and across all job functions in the enterprise and also include supply chain partners and even customers. Enterprise Reporting, in essence, provides business intelligence to the masses. As a result, it is the most prevalent Style of BI, encompassing a vast array of operational reporting directly from ERP and CRM systems, as well as scorecards and dashboards of overall business performance.

The single most dominant characteristic of any Enterprise Reporting system is its ability to produce highly flexible report formats, so that data can be presented in whatever form is most consumable to a wide range of information consumers. These individuals get their reports by accessing them on-demand through their Web browsers (web-based reporting), as well as by receiving distributions that are pushed to them via email or print delivery.

Beyond the baseline Enterprise Reporting characteristics listed above, what truly differentiates Enterprise Reporting technologies revolve around the following four key areas:

1. **Support For All Forms of Enterprise Reports** – From scorecards and dashboards at one extreme, all the way to operational reports at the other extreme, and the many variations in between.
2. **User-defined Web Reporting** – Making enterprise reports more compelling, personalized and relevant for each individual.
3. **High Throughput Report Production and Distribution** – Reaching all users through the touchpoints of their choice and making reporting ubiquitous and convenient throughout the enterprise.
4. **Pixel-perfect and Print-perfect Design Without Any Programming** – Making desktop publishing quality reports available without any programming.

The remainder of this chapter discusses each of these areas in detail.

3.1 Support For All Forms of Enterprise Reports

Report writing products typically either can deliver operational reports well or can deliver scorecards and dashboards well – but not both. MicroStrategy’s advanced architecture is designed to deliver both operational reports and scorecards and dashboards easily from a single platform. In fact, MicroStrategy allows users easily to develop the five common forms of enterprise reports that range from highly graphical Scorecards and Dashboards for executives to densely populated tabular Operational Reports for all personnel. In between these extremes are Classic Business Reports for business unit managers, Managed Metrics reports for business unit leaders and Invoices and Statements for customers and partners.

Delivering The Five Common Forms of Enterprise Reports – Ranging from Scorecards and Dashboards to Operational Reports

Report Form 1 – Scorecards and Dashboards for executives: Scorecards and dashboards (Fig. 6) are designed to deliver maximum visual impact to the user in a format optimized for quick absorption. MicroStrategy scorecards combine tables, graphs, gauges and other graphical indicators, conditional formatting, free-form labels, borders and background colors to achieve this impact.

Since enterprises need to convey key performance indicators (KPIs) based on a complete view of all financial and operational data, scorecards have to extend far beyond summary-level information. Scorecards built on the MicroStrategy platform utilize the full wealth of enterprise data and take advantage of its scalability, transaction level data access and ad hoc capabilities.

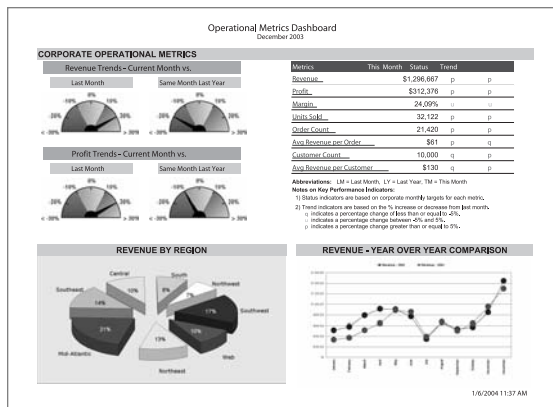


Figure 6 - Report Form 1: Scorecards & Dashboards

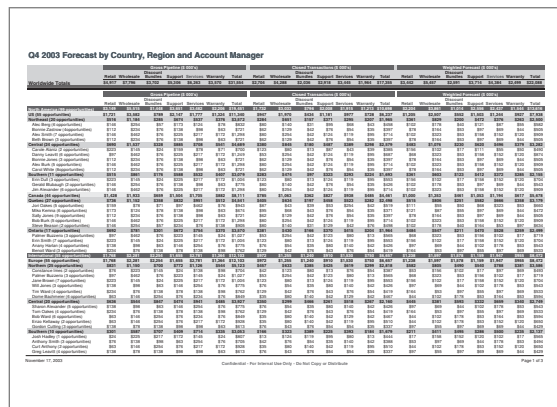


Figure 7 - Report Form 2: Operational Reports

Report Form 2 – Operational Reports for all personnel: The vast majority of enterprise information dissemination is in the form of traditional Operational Reports (Fig. 7). These time-tested reports display volumes of tabular data organized into a hierarchy of increasingly finer levels of detail.

MicroStrategy is adept at quickly organizing massive amounts of operational data into well-organized

repeating sections that might span many pages. Each page can include labels, headers and footers and page break logic that are the hallmarks of an effective operational reporting system.

Report Form 3 – Classic Business Reports for business managers: MicroStrategy’s free-form layout may be used to create popular business reports, such as P&L reports, performance reports and statutory reports. These reports are usually optimized for on-screen viewing and allow the user to drill to deeper details and related reports. Classic Business Reports (Fig. 8) easily combine tables, graphs and free-form field layout to create unique presentations of summary and detailed data.

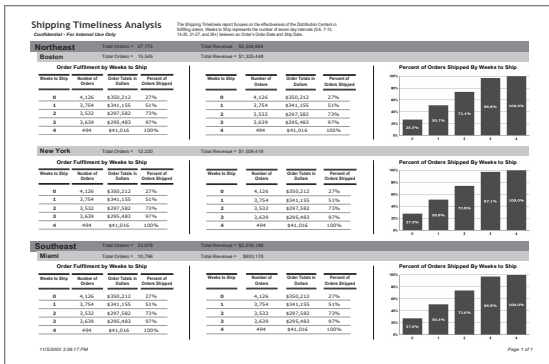


Figure 8 - Report Form 3: Classic Business Reports

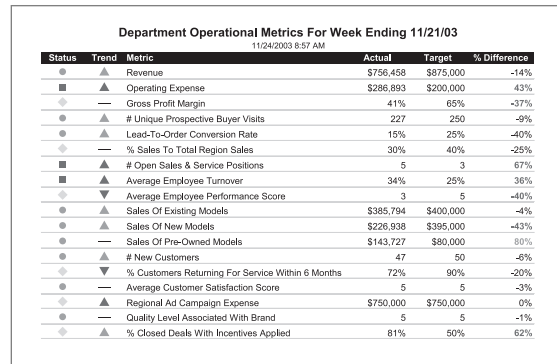


Figure 9 - Report Form 4: Managed Metrics Reports

Report Form 4 – Managed Metrics Reports for business unit leaders: The drive to manage business “by the numbers” and deliver predictable results has led to a renewed interest in Corporate Performance Management, or CPM. The cornerstone of CPM is the Managed Metrics Report (Fig. 9), which allows managers to track continually the status of business performance, including actual-to-planned comparisons, time series projections and process flow analyses.

With MicroStrategy, this is achieved using thresholds and graphical indicators to show attainment of performance goals, trends over time and status checks to manage to the metrics or targets. By incorporating predictive analysis native to the MicroStrategy platform, these reports can also display correlations and projections to help anticipate future business performance.

Report Form 5 – Invoices and Statements for customers and partners: Invoices and Statements (Fig. 10) contain detailed transactional data and summarized information for any number of customers and partners. This enterprise report form is designed with page layout precisely defined and report elements precisely formatted and positioned to ensure proper printing across multiple sheets and with pre-printed corporate stationery.

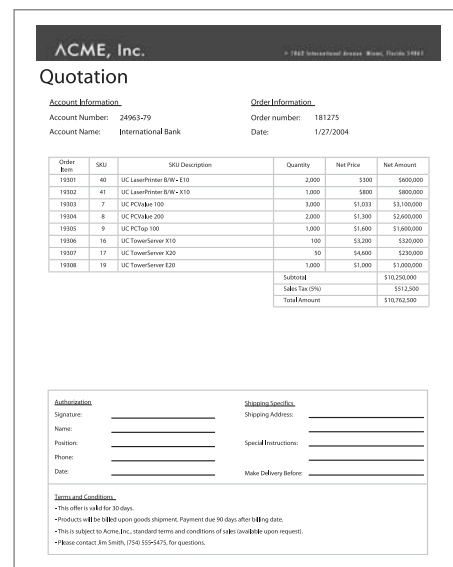


Figure 10 - Report Form 5: Invoices & Statements

To generate Invoices and Statements, MicroStrategy uses the same exacting page layout techniques as those used by desktop publishing packages.

Where other vendors require companies to purchase multiple different technologies, each targeted for a different form of enterprise report, MicroStrategy can deliver all five common forms of enterprise reports, all with uniform ease.

Uniquely Combining Zone-based Layout with Traditional Banded Report Layout

Only MicroStrategy can deliver all five forms of enterprise reports by uniquely combining zone-based layout with traditional banded report layout.

Banded Layout is the most familiar report layout technique today because it is the predominant vehicle for operational reporting. It has been the cornerstone of all leading report writers for years. The reason for the long-term popularity for Operational Reporting is because banded layout can very rapidly organize lots of data into a natural hierarchy of information that users can easily navigate.

The term “banded” refers to specific horizontal bands superimposed on the report layout screen that dictate where data should be automatically summarized for page headers and footers, report headers and footers, and within user-defined groupings or hierarchies that map to the business organization. For example, a banded report is the natural structure for describing product sales, when that sales information needs to be presented for every product, grouped by product category, and delineated for every store, within every region, for every month in a time period. Grouping and summarizing techniques come automatically with banded layouts.

Banded report layout is truly optimized for traditional operational reporting with its dense hierarchical information presentation, multi-page repeating sections that cover entire ranges of enterprise operations, and bias for fine printing optimization. MicroStrategy offers pure banded layout following the same visual paradigms that are now well understood by and familiar to any person who has created enterprise reports using any of the common report writing products available today.

Zone-based Layout, on the other hand, is optimized for the creation of Scorecards and Dashboards. The term “zone” refers to the graphical building block technique that allows users to layout entire tables and graphs onto a page or screen, where each of these tables or graphs has a presentation behavior of its own. Zone-based layout is optimized for displaying graphical content (as opposed to tabular information). Zone-based layout is further optimized for on-screen display, where users have scroll bars to move around the report and desktop publishing quality printing is not a requirement.

MicroStrategy users can build Scorecards and Dashboards on the fly using simple drag-and-drop techniques to insert multiple reports, graphs, text, hyperlinks, and images onto the report layout screen. These objects may also be arranged anywhere in the layout and automatically adapt to the size and shape of their content, moving other objects dynamically to fit.

Zone-based Layout Within Traditional Banded Reports.

One of the most important and unique aspects of MicroStrategy's Enterprise Reporting capabilities is the ability to freely combine powerful graphical zone-based objects within the powerfully organized banded report structure (Fig. 11).

When zone-based objects, like full cross-tabular tables or graphs are dragged and dropped within the grouping bands, the contents of those grids and graphs automatically adopt the level of aggregations dictated by the bands just as individual field layout would in a strictly banded report. This allows MicroStrategy users to develop truly unique report layouts of dynamic tables and graphs, interleaved and organized by classic repeating banded sections with very little effort and expertise.

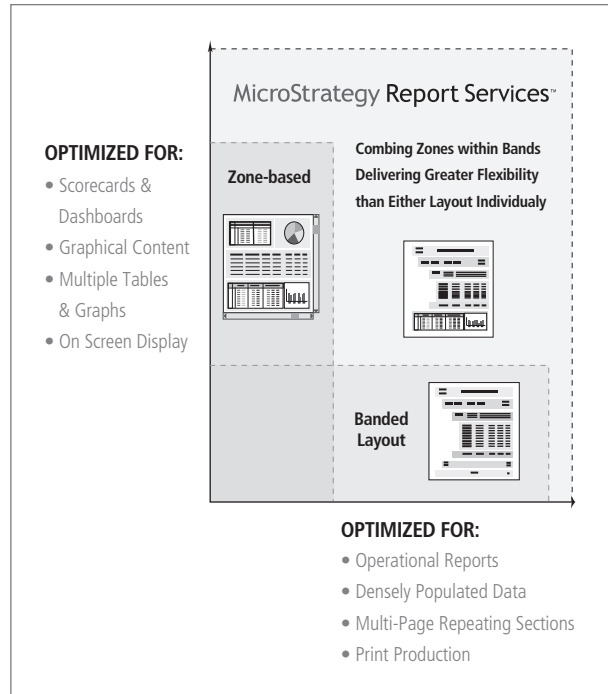


Figure 11 - MicroStrategy combines Banded and Zone-based layout to deliver the most flexible reporting environment

3.2 User-defined Web Reporting

The goal of every Enterprise Reporting project is to inspire people to use information in their day-to-day work activities. However, most projects fail to achieve this goal because the reports are not immediately relevant to each recipient user – that is, a user must sift through reams of numbers to find just the few sections that directly relate to his or her area of responsibility. The other reason reporting efforts fail to achieve their goals is because the Enterprise Reporting environment is not easily tuned to the diverse skills of a wide population of users – that is, the user interface is either too simple and appeals only to the most novice users, or it is too “feature-rich” and overpowers the novice users.

This is a very difficult technical challenge and most BI products fail miserably because they do not give the people enough control over the report contents and their Enterprise Reporting environment, nor do these products automatically tailor report content to fit the users interests and skill. MicroStrategy was designed specifically to solve this problem through four personalization levers:

1. Parameterized Reporting
2. Automatically Customized Content
3. Personalized User Interface Based On User Profile
4. Multi-lingual Support

Parameterized Reporting – Letting the User Define the Report Contents

Parameter-driven reports allow the user to answer a number of questions prior to running a report, and those answers dictate what content will be displayed in the report. It allows a user to generate just the data they are interested in seeing at that moment. For example, users may answer prompt questions such as “Which product would you like to analyze,” and “Over what period of time,” and “In which geographical areas,” and “For which customers.” This is the basic idea behind parameterized reporting, and many report writing products offer this basic level of user control. MicroStrategy has taken the basic idea of parameterized reporting and user prompting – and elevated it to new levels of user control.

MicroStrategy revolutionized parameterized reporting by being the first technology to implement advanced prompting based on a Prompt Engine. The MicroStrategy Prompt Engine lets users pick and choose report content completely independent of the report design. This unique prompting capability allows MicroStrategy users to create and use incredibly rich prompting functionality, and much more simply than users of any other BI software.

With the MicroStrategy Prompt Engine (Fig. 12), users get the ability to tailor:

- **Report Contents** – by picking filters to be used, identifying metric limits and thresholds, and selecting benchmark values to compare reported numbers against.
- **Report Layout** – by controlling the arrangement of columns, picking variables to act as cross-tabs organizers, and choosing the page-by grouping of reports
- **Workflow** – by selecting cascading prompts, defining triggers for alerts, and directly importing results from other reports.

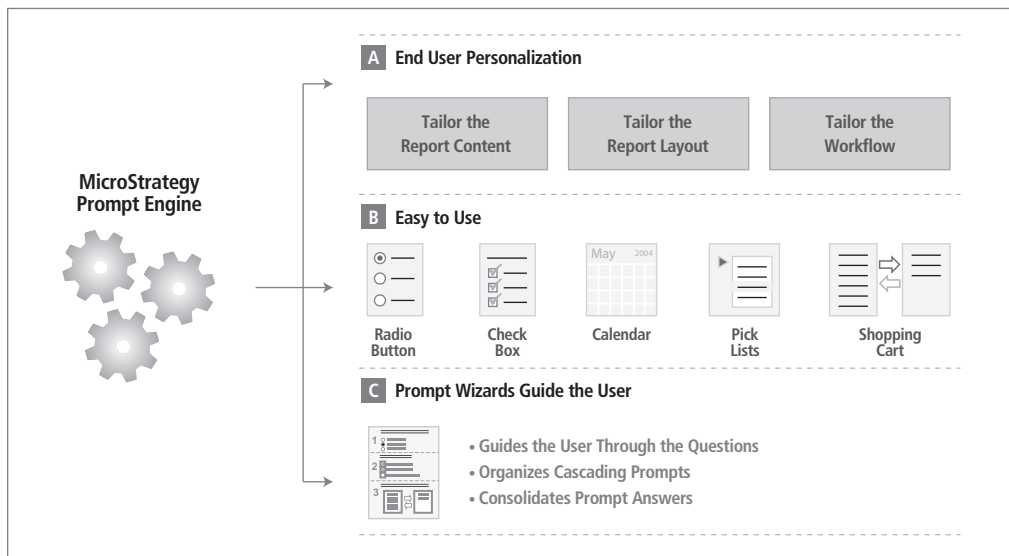


Figure 12 – The MicroStrategy Prompt Engine, an integral component of the MicroStrategy architecture, enables user-defined report content personalization, report layout, and workflow.

MicroStrategy’s advanced prompting capability makes all of this control and tailoring simple for people by using a wide range of familiar visual cues like radio buttons, check boxes, calendar date selection, drop-down pick lists, and shopping carts. MicroStrategy users are guided through answering sophisticated prompts with a Dynamic Prompt Wizard (Fig. 13) in an easy step-by-step fashion.

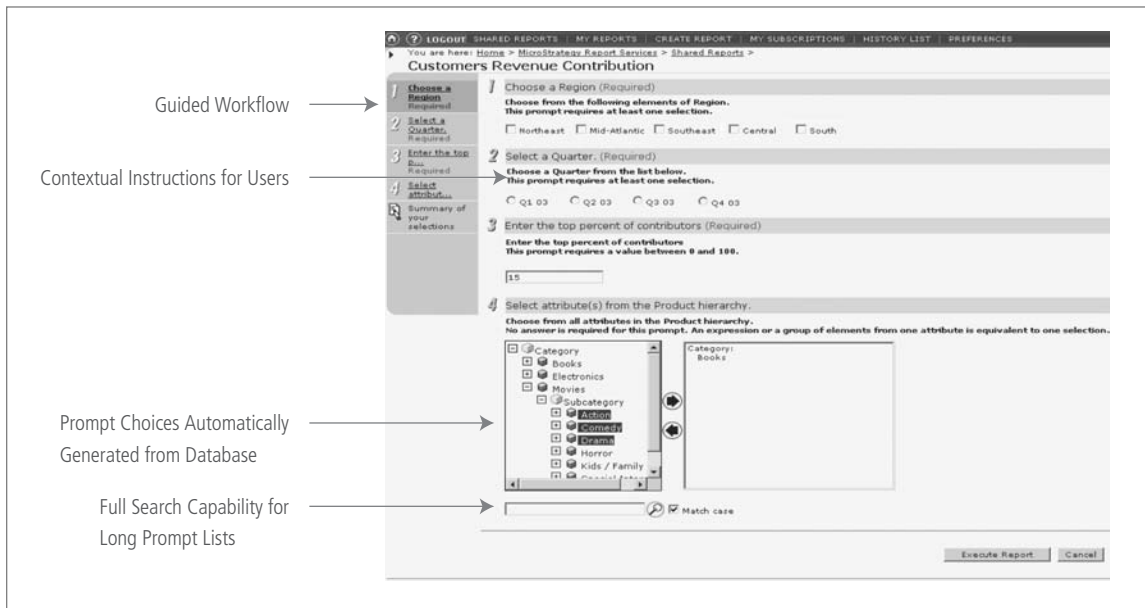


Figure 13 – MicroStrategy’s parameter driven report creation over the Web allows any user to create simple and sophisticated reports without administrative help.

Once the prompted questions are answered, users can further personalize the report. For example, users can qualify on metrics by extracting for instance only the top or bottom 10% of products by revenue. Users may re-prompt a report as many times as needed using permutations of different answers to create what-if and scenario analyses.

The Dynamic Prompt Wizard manages the full user experience in a report, with:

- Guided workflow, step-by-step, letting users see the answers they have given in one quick view.
- User instructions about how to answer the prompt questions and which answers are required and which are optional.
- Multiple-choice lists with possible answers automatically generated by the system, so programmers and users don’t need to remember all possible choices.
- Search tool that lets users jump quickly to a prompt answer selection, which is especially useful when the choice list is very long.

MicroStrategy’s Dynamic Prompt Wizard automates prompt design and prompt rendering, which in turn gives enterprises powerful parameterized reporting.

Automatically Customized Content – Allowing One Report to Serve The Needs Of Thousands Of Users Automatically Through Role-based Content

A common challenge in Enterprise Reporting is how to deliver similar information to very large populations of users economically, where each user needs to see a different slice of the data. The traditional solution is to provide each user with a custom-designed report. Clearly this is a nightmare for the report designers because one small change needs to ripple through many renditions of the report.

With MicroStrategy, IT administrators only need to create one report that the system automatically slices into the different views appropriate for each individual user. In addition, MicroStrategy content slicing takes place along any number of business attributes based automatically on each user’s role and group affiliations.

The MicroStrategy architecture automatically creates personalized variations of any report definition based on the group affiliation and role of every report user (Fig. 14). With MicroStrategy, any report can be sliced along many dimensions automatically to make the report content immediately relevant to the recipient users.

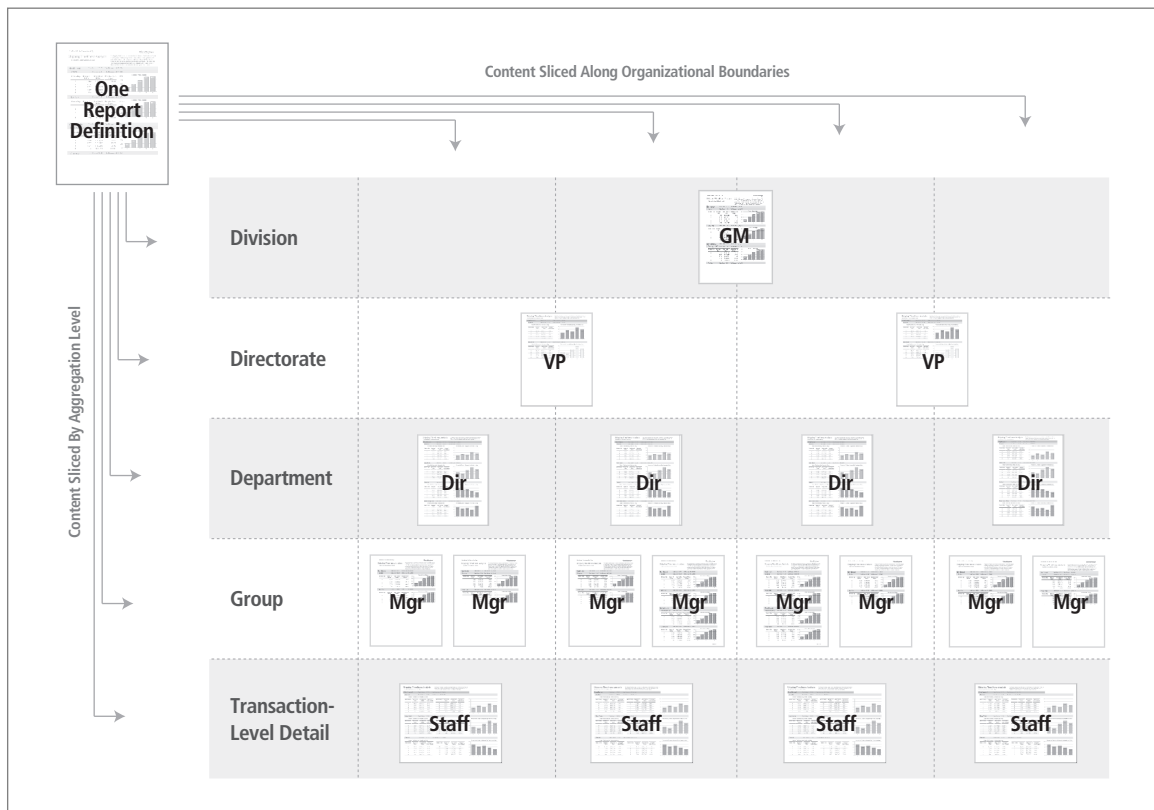


Figure 14 - One MicroStrategy report can serve many users because MicroStrategy automatically slices the report based on each user’s role and group affiliations.

Personalized User Interface Based on User Profile – Matching User Interface Functionality Level With User Skill Level

Enterprises face a challenge when striking a balance between exposing rich functionality to power users, while at the same time giving novice users a simple Enterprise Reporting environment that will not overpower them.

MicroStrategy is designed to solve this problem elegantly through the user of user profiles. User profiles automatically adjust the Web interface to accommodate users with different skill levels. User profiles determine exactly what functionality will be exposed to each user or user group (Fig. 15). So it's easy in MicroStrategy to give report designers a user profile with maximum functionality, while the report consumers receive a user profile with just enough functionality to do their jobs easily.

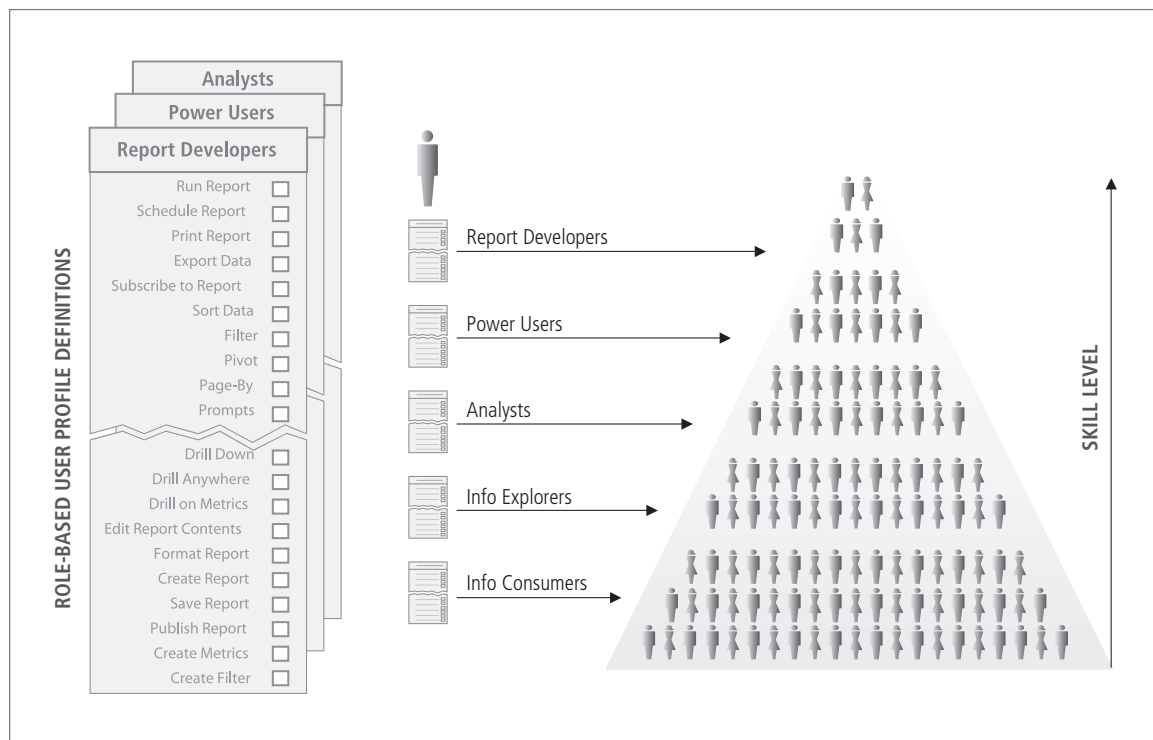


Figure 15 – MicroStrategy matches user profiles with user skill levels to expose functionality in an elegant fashion.

MicroStrategy can support any number of finely tuned user profiles to accommodate the huge diversity of real people in real organizations. What's even more important is that as user skill levels increase, an IT administrator can easily turn on more power for any given user in a centralized fashion with the simple check of a box in the MicroStrategy platform.

Multi-lingual Support

Enterprise Reporting must span the globe with reports personalized to the local languages in which they are accessed. With MicroStrategy, users can access their Enterprise Reporting environment in twelve different languages out-of-the-box: American English, British English, Chinese (Traditional), Chinese (Simplified), French, German, Italian, Japanese, Korean, Portuguese, Spanish, and Swedish.

MicroStrategy report translation includes all of the interface items like menu bars and online help. It also includes character sets, currency formats, time and date formats, and even business attributes and metrics in the report (Fig. 16).

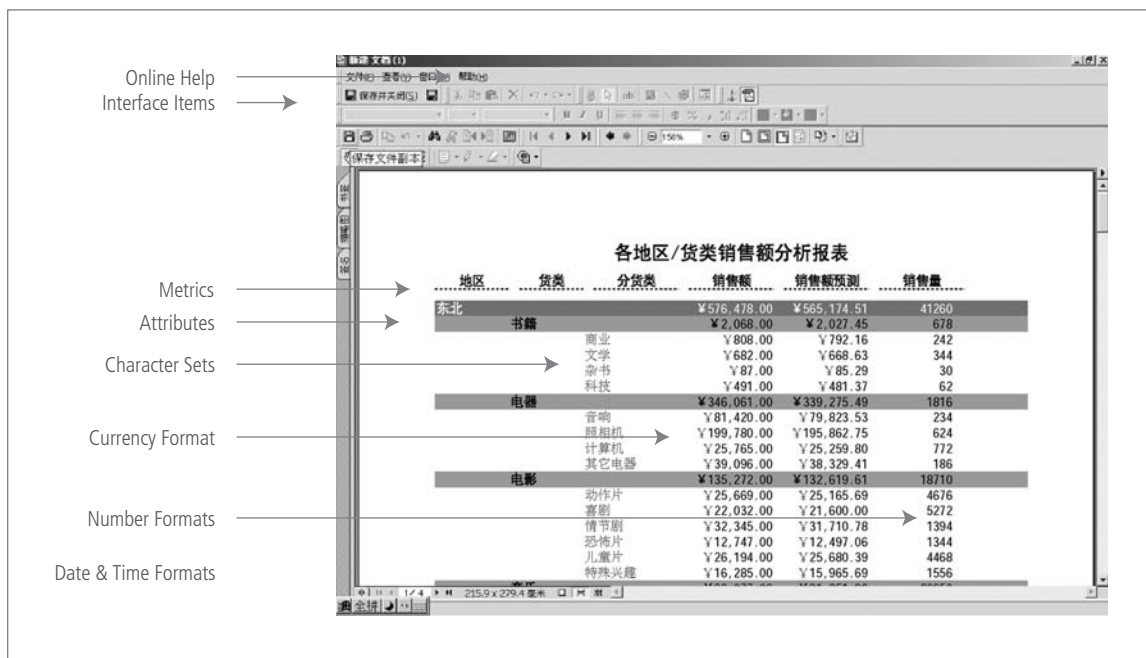


Figure 16 – MicroStrategy automatically translates reports into the appropriate language.

3.3 High Throughput Report Production and Distribution

Information consumers are everywhere. They are in executive offices, in office cubicles, on warehouse floors, at loading docks, at customer sites, at suppliers' offices, and at customers' homes. Effective Enterprise Reporting systems must be able to reach all of these users, wherever they are and with sufficient power to generate tens of thousands of reports per hour if needed.

The MicroStrategy architecture sets the standard for high volume, high flexibility report distribution. MicroStrategy reports can be automatically distributed to the widest range of user touchpoints on the market, including Web browsers, networked printers, email, networked file servers, and corporate portals (Fig. 17).

MicroStrategy reports can be delivered directly to any **Web** browser, both inside and outside the corporate firewalls because MicroStrategy is the only vendor employing a true zero footprint Web architecture, which requires no downloads, ActiveX, or cookies. MicroStrategy’s unified Web interface is proven efficient and effective with user populations in excess of 100,000 individuals internal and external to the enterprise.

MicroStrategy reports can also be **printed** in a batch production mode. This is a mode where every individual print job might be directed to a different networked printer that is associated with each recipient user. And, the content will be automatically personalized to each recipient on his or her printer.

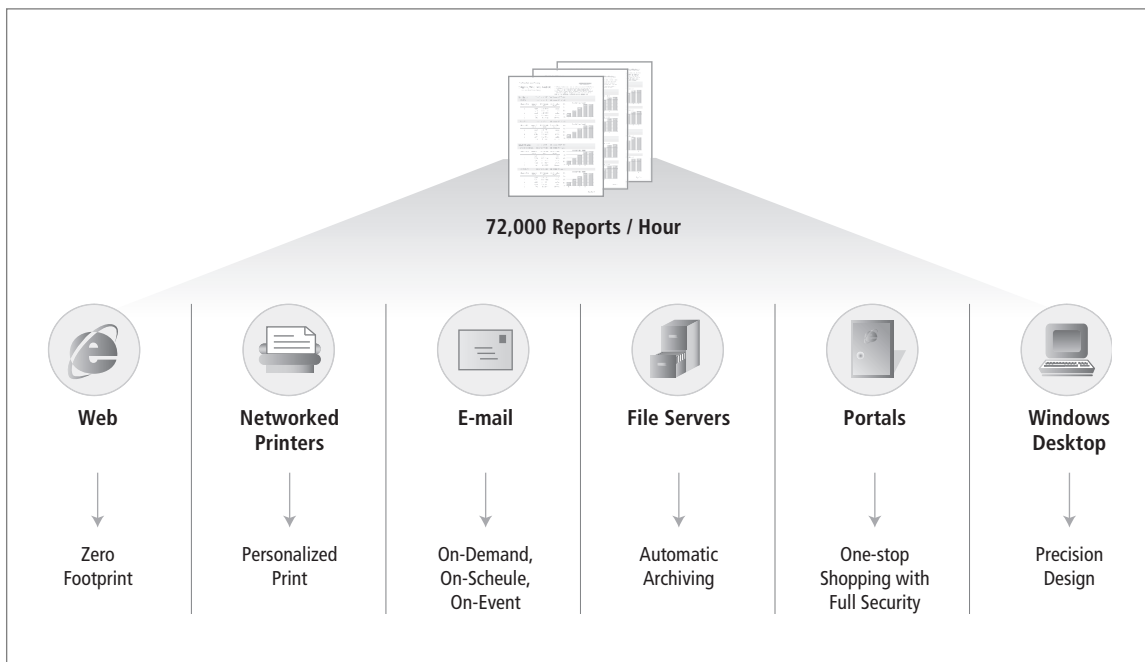


Figure 17 – MicroStrategy’s report distribution capabilities allow enterprises to reach every user through the touchpoint of his/her choice.

MicroStrategy reports can be delivered through any **email** system either:

- On-demand – where users immediately email the report to an individual or group.
- On-schedule – where users set up subscriptions to receive reports on a periodic basis, such as every Monday morning.
- On-event – where event-driven email report alerts are sent to users based on metrics or KPIs reaching certain threshold conditions within the database.

MicroStrategy can automatically distribute reports directly to **networked file servers**, creating new archive folders for each new batch of reports. Additionally, MicroStrategy can automatically post reports directly to **corporate portals** to allow one-stop shopping for all corporate information assets. Users can access MicroStrategy reports directly from a **Windows desktop** or Web, providing the highest fidelity design precision available.

3.4 Pixel-perfect and Print-perfect Design Without Any Programming

Typical report writing products are optimized for either on-screen presentation or for print generation, but not both. Moreover, many of these report writers require extensive programming to deliver all but the most rudimentary reports.

Page Layout Paradigm Delivers Pixel-perfect and Print-perfect Designs

MicroStrategy is different. MicroStrategy can deliver pixel-perfect reports for on-screen presentation, as well as print-perfect reports for physical distribution, letting users create desktop publishing quality documents for either media (Fig. 18). What’s even more important is that MicroStrategy users can do this without the need for any programming or outside help – it is all drag-and-drop.

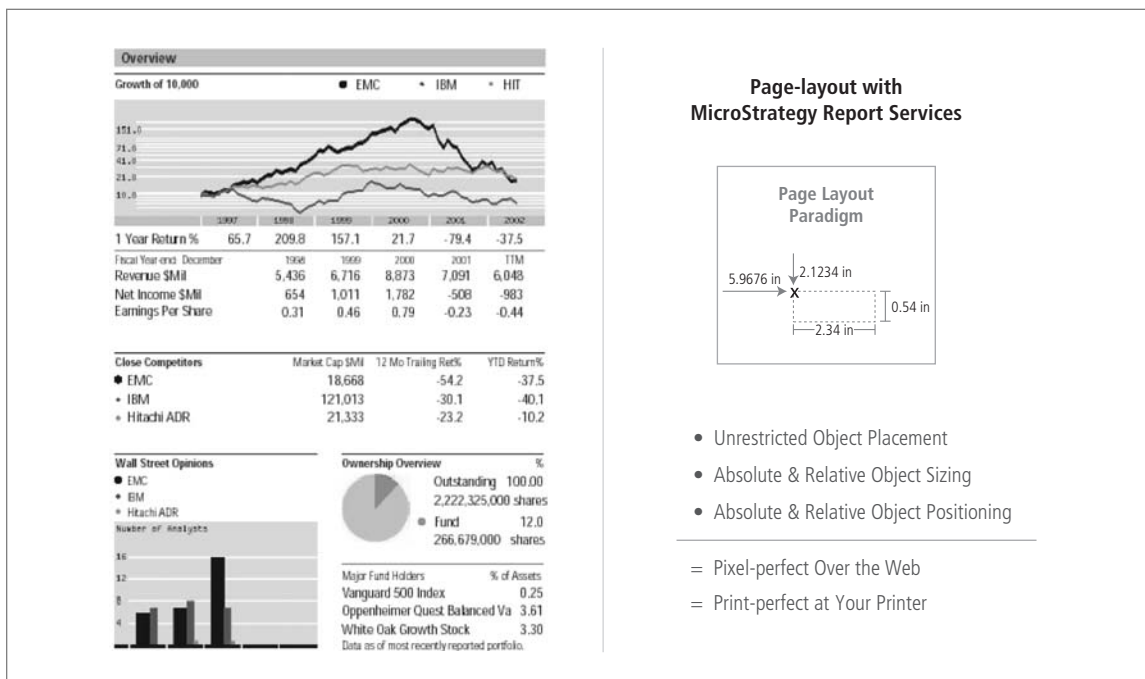


Figure 18 – MicroStrategy uses a page layout paradigm just like the desktop publishing packages. This guarantees the highest resolution for pixel-perfect on-screen reports, as well as most exacting placement for print-perfect physical reports.

MicroStrategy uses a page layout paradigm as its design model (as opposed to the HTML layout paradigm used by some report writing tools). Page layout is the same design paradigm employed by desktop publishing packages and used for the most demanding information publishing tasks. It is the only layout paradigm that gives the report designer full and absolute control over the placement and sizing of all objects, whether users ultimately will be viewing on-screen or on paper.

Sophisticated Report Design Without Any Programming

MicroStrategy’s Report Design Screen (Fig. 19) presents default sections or bands that immediately help users to layout document headers/footers, page headers/footers, summarization groupings, and all the

details. Repeating sections are automatically handled by the summarization groupings. Users are also presented with the list of business attributes and metrics on the left to be dragged-and-dropped onto the layout field in the middle. On the right side of the screen, a Properties Window allows the report designer to set the behavior of every object on the report without the need for any programming.

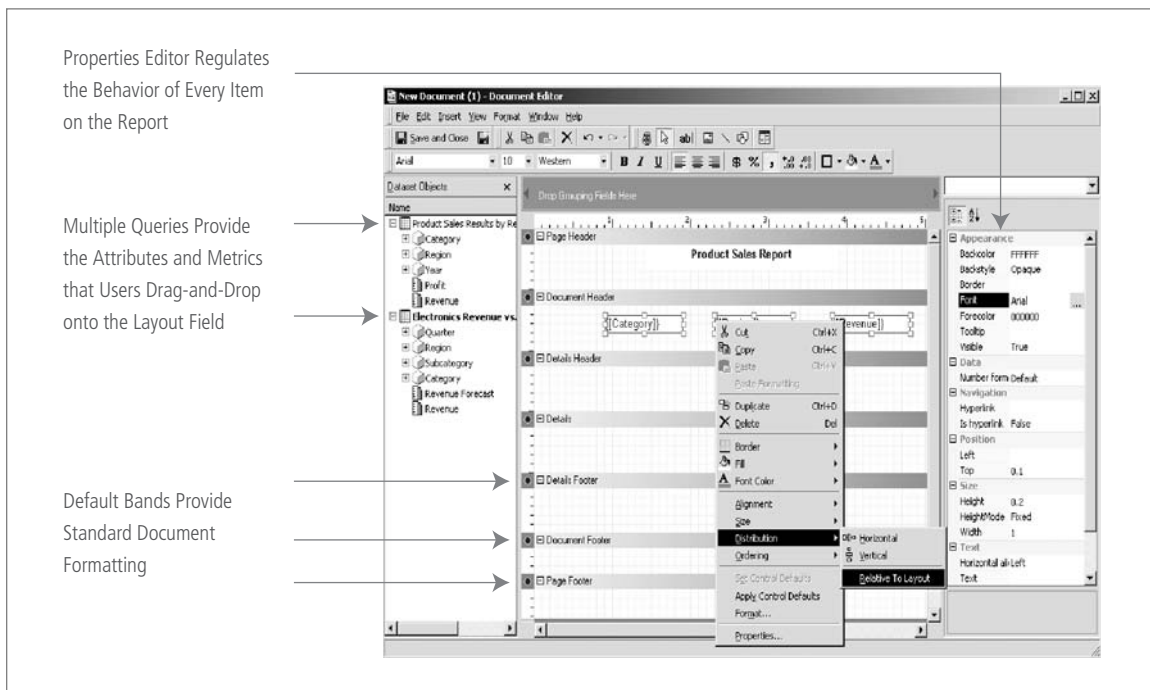


Figure 19 – MicroStrategy’s Report Design Screen provides powerful report design, letting users simply drag-and-drop all within one window.

Familiar Tools Allow Anyone to Create Enterprise Reports

Anyone can create a finely formatted MicroStrategy report because the formatting controls (Fig. 20) will be instantly familiar to anyone who has used Microsoft® PowerPoint® or a desktop publishing package. MicroStrategy includes all of the familiar drawing controls for object sizing, alignment, distribution, front-back ordering, snap-to-grid, borders, fill colors, fonts, and autostyles. Additionally, MicroStrategy provides more than 80 graph types, including advanced three-dimensional graphs. And all of these techniques are accessible directly through standard drop-down menus or via a right-mouse-click.

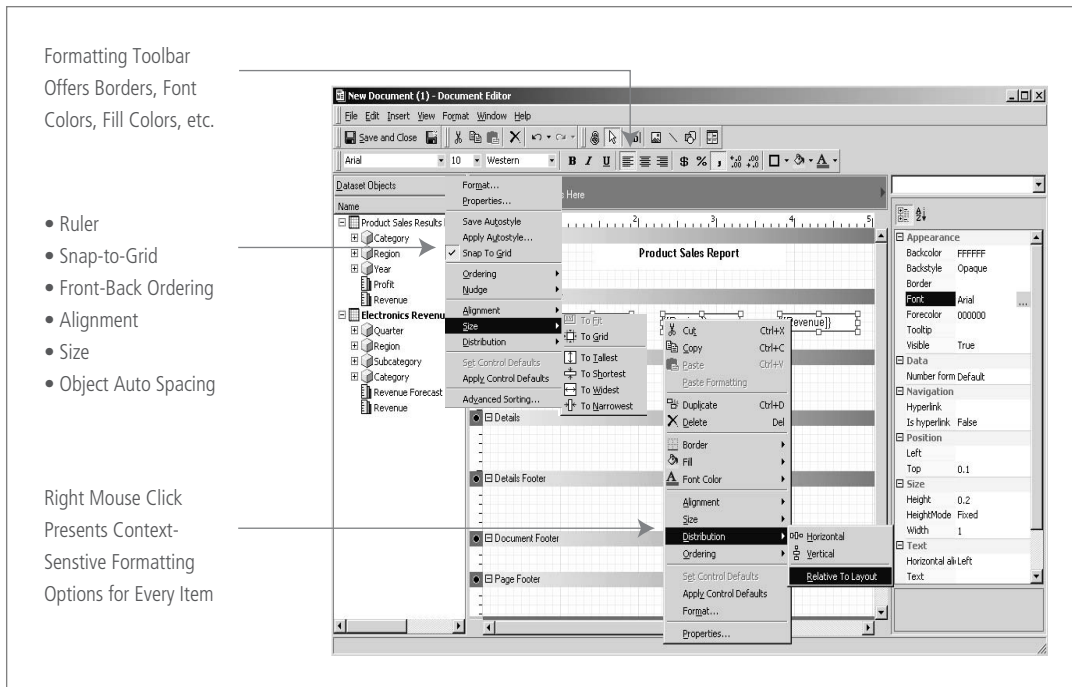


Figure 20 – MicroStrategy users are able to format reports intuitively. All of the formatting controls will be instantly familiar to all users of Microsoft PowerPoint, drawing programs and desktop publishing programs.

3.5 Enterprise Reporting Summary

MicroStrategy’s Enterprise Reporting technology provides the most comprehensive and flexible reporting capabilities available to deliver:

- **Highly Compelling Reports** – by combining traditional banded layouts with zone-based layouts to produce the full range of common enterprise report forms – from scorecards and dashboards to operational reports.
- **Highly Consumable and Personal Reports** – by catering to an individual’s needs in terms of report content and user interface environment – through prompting, user profiles, role-based content, and multi-lingual support.
- **Pervasive and Convenient Reports for All People** – making reporting ubiquitous throughout the enterprise and externally by delivering reports to every user conveniently through all touchpoints of their choice.
- **Pixel-perfect and Print-perfect Reports** – Simple-to-build using precision page layout techniques and without the need for any programming.

All of these Enterprise Reporting capabilities are available within the MicroStrategy architecture, which delivers all 5 Styles of BI, allowing users to move fluidly from scorecarding and basic operational reporting to ever increasing levels of analysis.

4

CUBE ANALYSIS

Cube Analysis delivers the simplest form of analysis, allowing anybody to analyze data. Cube Analysis is used most often by people like managers who have a deep interest in understanding the root causes underlying the data in reports, but do not possess skills for full ad hoc investigation of the databases.

Cube Analysis lets people flip through a series of report views, using the now standard OLAP features of: page-by, pivot, sort, filter, and drill up/down. These OLAP features, which were first introduced in the early 1990s, allow users to slice-and-dice a cube of data, or analysis cube, using simple mouse-clicks. The term “cube” refers to a subset of highly interrelated data that is pre-organized to allow users to combine any attributes in the cube (e.g. stores, products, customers, suppliers) with any metrics in the cube (e.g. sales, profit, units, age) to create various 2-dimensional views, or slices, that can be displayed on a computer screen (Fig. 21).

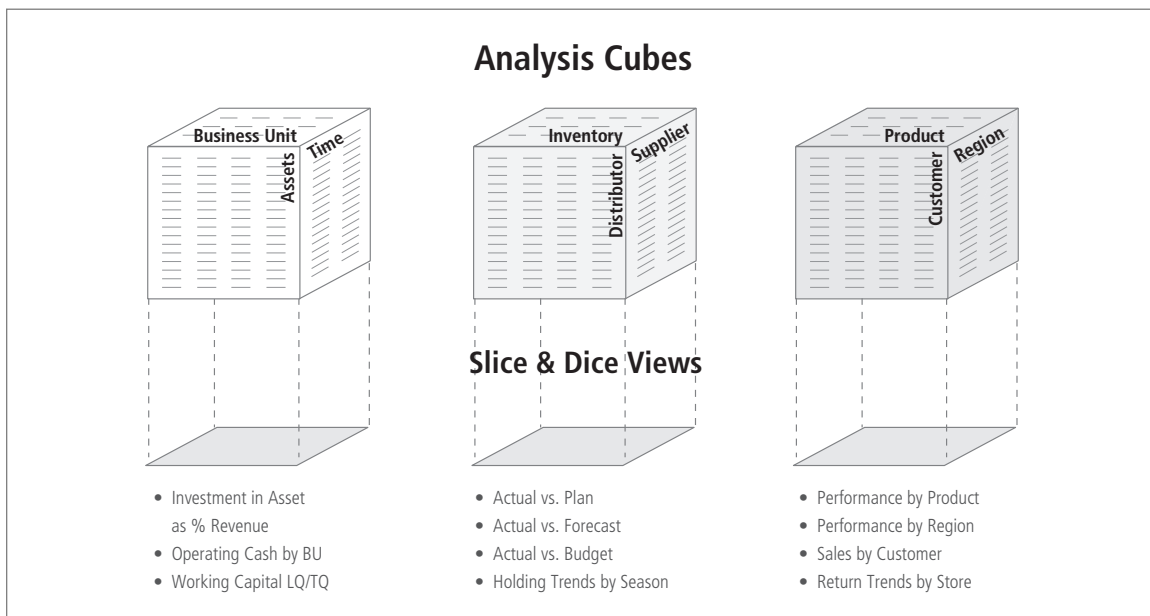


Figure 21 – OLAP features such as page-by, pivot, sort, filter, and drill, allow users to slice-and-dice domain-specific data subsets, and view the data from many different perspectives.

To implement Cube Analysis functionality, most OLAP vendors use custom-made proprietary cube databases. This technique is known as Multidimensional OLAP or MOLAP. Unfortunately, the cube databases have very small data capacities – less than 0.01% of real relational databases – because they don’t have the technical underpinnings of real relational databases. Nonetheless, this capacity limitation was not initially perceived as a problem because most early departmental BI applications only needed between 10MB and 100MB of detailed and summary data. Problems due to limited cube data capacities began occurring when companies found they needed to deploy hundreds of overlapping cube databases to cover all the combinations of data subsets, summarization levels, and security privileges for different user groups across multiple applications. These ever-growing collections of cubes have become known as “cube farms.” Cube farms create an immense burden on the IT groups that have to generate the cubes, pre-calculate the summarizations, distribute them to users, and retire them when their data become outdated.

By contrast, MicroStrategy implemented its OLAP functionality by modeling the relational database as a “virtual multidimensional cube” with a technique known as Relational OLAP or ROLAP. MicroStrategy users have the same OLAP functionality of page-by, pivot, sort, filter, and drill, but can do so against the entire relational database. With ROLAP, the data is always the very latest data – there is no limitation of what data can be analyzed, and all users and security work uniformly against the database (Fig. 22). The tradeoff that early MicroStrategy users paid for the vastly greater range of data access was somewhat slower response-times and the potential for overwhelming novice users by allowing them to analyze the entire database, rather than a simple subset. That’s why MicroStrategy introduced Intelligent Cubes™.

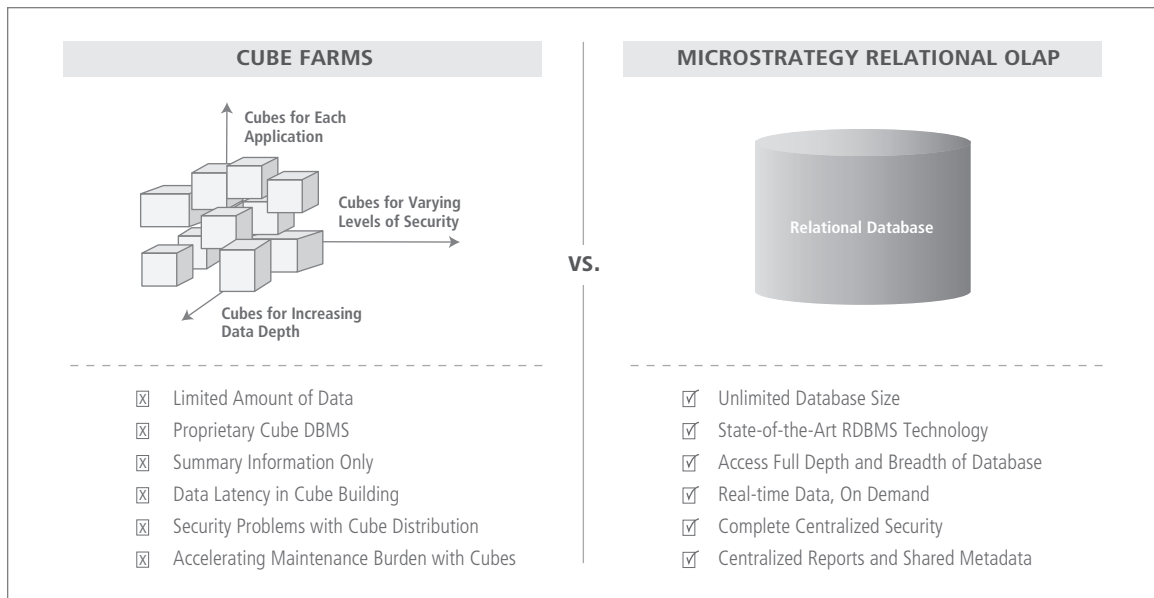


Figure 22 – MicroStrategy was designed to take complete advantage of the full power of database platform technology and avoid the burden of cube farms.

MicroStrategy’s Intelligent Cubes provide all of the same OLAP functionality that small-scale MOLAP cubes provide, but with significant enhancements available only with a ROLAP underlying architecture.

1. **Speed-of-Thought Report Analysis and Manipulations** – Analysis of cubes with speed-of-thought performance and powerful slice-and-dice capabilities.
2. **Ad Hoc Drilling from Summary Data to Transactional Details** – Seamless drilling capabilities outside the cube domain to anywhere in the data warehouse.
3. **Cube Sharing with Personalized Views and Security** – Transparent and secure sharing across the enterprise of cubes with personalized views.
4. **Automatic Creation and Synchronization of Cubes** – Creating cubes on the fly with automatic refresh of data for real-time analysis.

The remainder of this chapter discusses each of these areas in detail.

4.1 Speed-of-Thought Report Analysis and Manipulations

MicroStrategy’s Intelligent Cube technology lets users perform report manipulations on a multi-dimensional cache of data rather than a limited, proprietary cube database. These caches are instantly populated by the simple action of “running a cube” and remain in shared cache for as long as the data is valid and people are using it. This eliminates the entire IT overhead imposed by managing cube farms.

Intelligent Cubes Provide Speed-of-Thought User Information

Intelligent Cubes give users a much greater range of functionality. With Intelligent Cubes, people can quickly add or remove report objects and modify report-filtering criteria with drag-and-drop actions in the Web interface. Additionally, users can add new calculations or modify existing calculations on the fly with an Excel-like formula bar, utilizing the full power of MicroStrategy’s Library of Statistical and Mathematical Functions.¹ All of these convenient user actions – adding/removing objects to/from a report, filtering a report with new criteria, and creating new metrics – do not require going back to the database and are performed with speed-of-thought response time (Fig. 23).

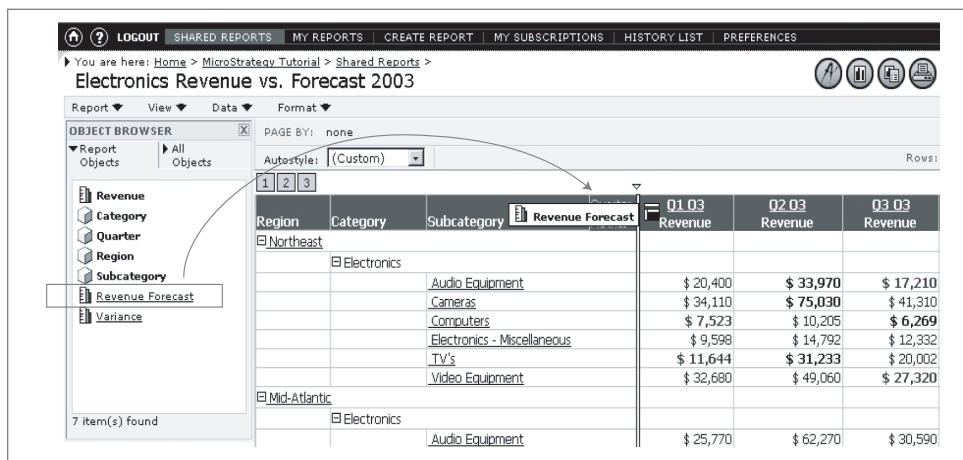


Figure 23 – MicroStrategy users create business metrics on the fly with simple drag-and-drop of base metrics or by simply typing the equation in the formula toolbar.

¹ Refer to Chapter 6 (Section 6.1) for information on the MicroStrategy Library of Statistical and Mathematical Functions

For example, a user who wants to augment or modify a report to support an investigative analysis can drag-and-drop metrics onto the report or create a new metric (Fig. 24). As a simple example, on a report with revenue and cost metrics, a user can calculate a new profit metric on the fly by subtracting the cost metric from the revenue metric, even though the profit metric in this case did not exist in the initial report cube.

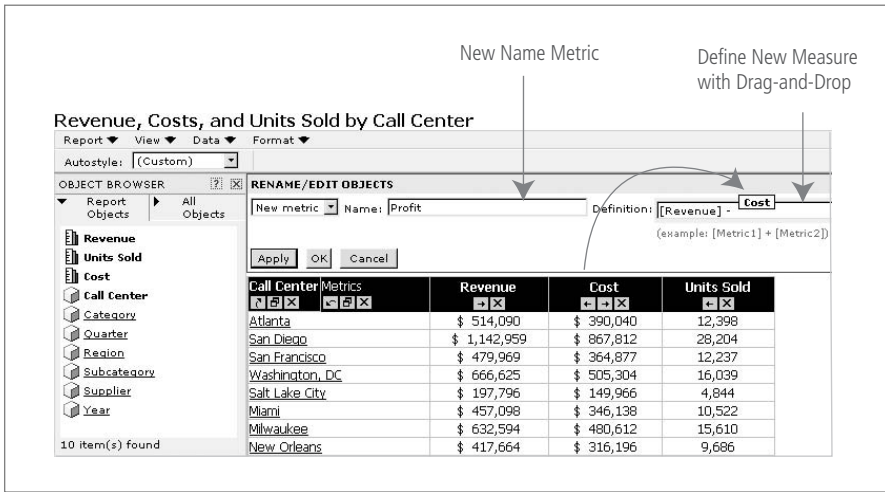


Figure 24 – MicroStrategy users create business metrics on the fly with simple drag-and-drop of base metrics or by simply typing the equation in the formula toolbar.

In addition, users can apply new filtering criteria on the fly (Fig. 25). For example, a user can filter a product profitability report to view only the products that make up the top 10% of profits – this calculation is performed within the Intelligent Cube itself.

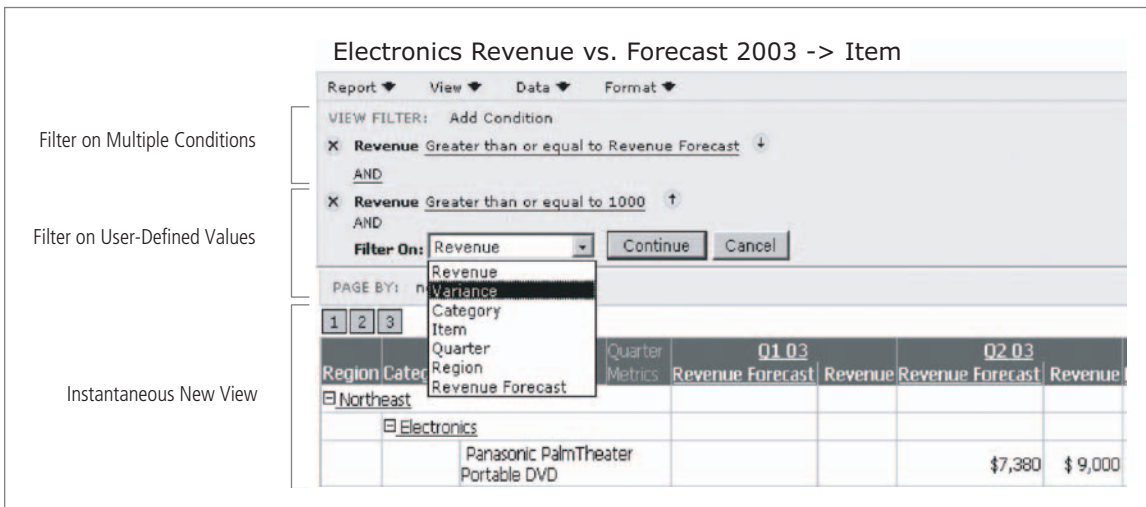


Figure 25 – MicroStrategy users may easily view and edit filtering for rapid, iterative result refinement on the fly.

Furthermore, users can dynamically page-by business attributes and pivot the rows and columns of an Intelligent Cube.² For example, when reports display a large number of rows for regional sales, users can

² Refer to Chapter 5, Ad Hoc Query and Analysis, to see how easily MicroStrategy users can rearrange report data by business attributes with drag-and-drop and right-click actions to Page By and Multi-Key Sort.

page by region to view one region at a time or to compare different regions. Users can also rearrange data systematically using multi-key sorts. Sorting can be applied to multiple columns in a hierarchical manner, such as sorting on one column alphabetically ascending, on another column alphabetically descending, and on another column ranked numerically by business metric value. Users can also apply powerful subtotals using all available functions in the MicroStrategy Library, such as total, average, maximum, minimum, and standard deviation, as well as many custom functions (Fig. 26).

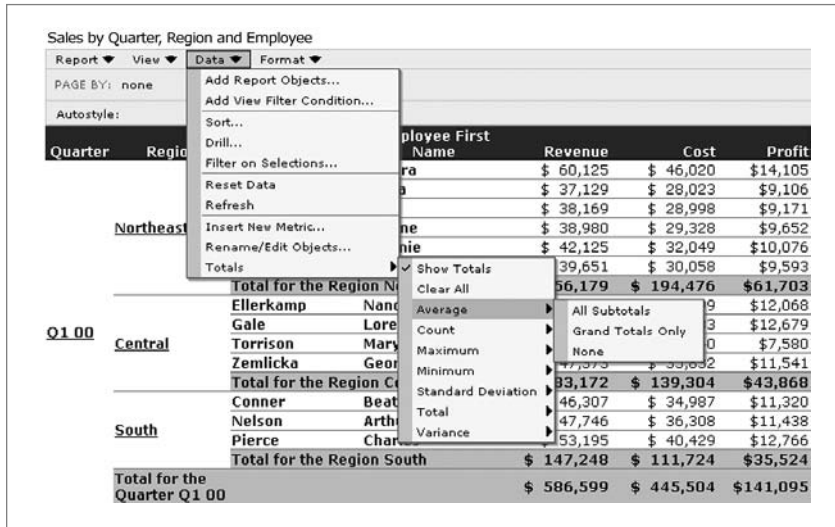


Figure 26 – Cube Analysis with MicroStrategy gives users the opportunity to manipulate reports, such as adding subtotals, in speed-of-thought time as shown above.

When any of MicroStrategy’s slice-and-dice capabilities are used, MicroStrategy’s Intelligent Cube retrieves and formats the data without going back to the database. Cube Analysis with MicroStrategy allows ad hoc data manipulations, new calculations, and filtering applied against the Intelligent Cube directly as opposed to accessing the database.³

Minimized Administrative Costs and Workload

MicroStrategy automatically creates Intelligent Cubes when users view or edit reports. MicroStrategy empowers users to create and modify their own cube definitions at any time, from any Web browser, and without administrative help. Users create and modify cube definitions by simply dragging-and-dropping report objects, such as business attributes and metrics. At that point, MicroStrategy automatically generates optimized structured query language (SQL) to create the Intelligent Cube. MicroStrategy intuitively uses the appropriate Intelligent Cube or creates a new Intelligent Cube on the fly to satisfy any user’s ad hoc request.

Users can modify existing Intelligent Cubes by adding or removing business attributes and metrics from across all enterprise business dimensions or creating new calculations on the fly from existing metrics in an Intelligent Cube. The new calculation is performed without submitting a new request to the database. Users can also filter their view of the data within an Intelligent Cube. For example, a user can drag-and-

³Refer to Chapter 5 (Section 5.3) for information on OLAP Analysis Against the Entire Database

drop the business attributes region, month, and product as well as the metrics revenue and cost to create a cube that shows product sales within specific regions at a specific time. The user might then calculate a new profit metric on the fly derived from revenue and cost, and then filter only the products with more than 5% profitability. The user could also calculate percentage increase in sales for these products by dynamically subtracting the current month's sales from last month's sales and applying appropriate arithmetic operators.

4.2 Cube Sharing with Personalized Views and Security

IT administrators struggle with maintaining and managing multiple cubes with duplicated data across user desktops, Web servers, file servers and other locations. The architectures of other BI software spread data across multiple systems within the enterprise. Consequently, users are at risk of analyzing outdated data on their desktops and using different analytical definitions of the same business terms due to decentralization of information across physical cubes of data. Thus, cube-based BI users cannot reliably share insights because dissimilar numbers can show up on the same report definitions.

Easy Sharing Of Intelligent Cubes Data With Centralized Metadata and Server Architecture

Only the MicroStrategy architecture is structured on a centralized and unified metadata that stores all business terms and data warehouse object definitions in one location. All information about reporting and analysis applications, users, reports, metrics and filters are stored in the metadata and can be shared by all users through the MicroStrategy architecture's centralized server. When an administrator creates a new Intelligent Cube, all users can access it instantaneously. Business terms and definitions are standardized across the enterprise. When multiple users with the same security levels run the same report, they get the same data. These users can also share this information easily with other internal and external users simply by saving the reports in a shared folder. Since these shared folders are also stored in a central location, all system users can easily access saved reports over the Web or on the Windows desktop. Additionally, users can email reports directly from the Web.

Sharing Intelligent Cubes Data With Personalized Views

When analyzing Intelligent Cube data, users can add, edit and remove business attributes and metrics. These actions result in various personalized views of the same Intelligent Cube. Users can then save these views so that the next time they run the Intelligent Cube, it will reflect their personal view. Thus, a report designer can deploy one Intelligent Cube shared by all users, each with a personalized view. Hence, all personalized views are logically linked to the single published report; and, regardless of the view, all users are accessing the same up-to-date data.

Secure Sharing of Intelligent Cubes

IT administrators can be assured that Intelligent Cubes are shared securely because they use MicroStrategy's same multi-tiered security that applies to all Styles of BI with MicroStrategy. As a simplified example, an administrator can design a report with ten business attributes and metrics. Both John and Martha can share the same Intelligent Cube data, but Martha can view all ten objects and John can view only six of the ten since his security profile denies him access to the additional four objects to which Martha has access.

¹ Refer to Chapter 5 (Section 5.2) for complete information on MicroStrategy's Drill Anywhere capabilities.

² Refer to Chapter 6 (Section 6.5) for complete information on MicroStrategy's unique multi-pass SQL generation capability.

4.3 Automatic Synchronization of Intelligent Cubes' Data

IT administrators of other BI software spend most of their time managing and updating cubes based on business users' requirements. In those cases, administrators maintain multiple cubes in different locations, such as user desktops, Web servers and file servers. Cube data must be duplicated across these various locations and can quickly become a nightmare to manage and keep synchronized with the latest data. By contrast, the MicroStrategy architecture delivers MOLAP by automatically creating and populating Intelligent Cubes in the centralized metadata for use across the entire enterprise. Intelligent Cubes are automatically managed – with cube data always up-to-date and synchronized – without an administrator's involvement.

MicroStrategy administrators have the option of configuring Intelligent Cube data to expire or refresh automatically, using time-based schedules or event-based triggers such as data loads or table modifications. Because of this automatic refresh, business users can be confident that Intelligent Cube data is always up-to-date for accurate decision-making. For instance, an administrator can schedule Intelligent Cubes to be refreshed every evening at 10:00 PM so that users access up-to-date data everyday. When a table column in the database is updated, the data of the Intelligent Cubes affected by the change is automatically refreshed. In addition, administrators can use text-based commands and scripts, custom, or third-party tools to further automate treatment of Intelligent Cube data.

4.4 Ad Hoc Drilling from Summary Data to Transactional Details

With MicroStrategy, executives and managers can quickly assess summary level KPIs on scorecards or other reports before drilling to analyze detailed and even transaction level information. This drilling from KPIs to detailed level information generates the most valuable insight – for example, finding the root problem of a specific product's declining sales. Drilling from a summary level KPI to transaction level details is effortless with the MicroStrategy architecture. Other BI software fails to achieve transaction level analysis without intensive IT administrative assistance – for this reason, other BI software frequently restricts users to very basic summary analysis and static drill paths at best.

MicroStrategy enables powerful Drill Anywhere, letting users freely drill beyond Intelligent Cubes to the full breadth of their enterprise data warehouse.⁴ These user actions are possible because of the combination of Intelligent Cube technology with the industry's only multi-pass SQL generation.⁵ Users do not have to think about how to create a cube or run queries against the database – they can intuitively perform speed-of-thought analysis using MicroStrategy, moving seamlessly from Cube Analysis to Ad Hoc Query and Analysis. MicroStrategy automatically handles the cube creation and drill actions behind the scenes, without interrupting a user's workflow. For example, at a leading telecommunications company, analysts needed a revolutionary method to analyze customer call logs, contributions and profits that would go beyond summary level reports such as Top 100 gainers or decliners by product or geography. Using MicroStrategy, the analysts were armed with the ability to drill through the summary level numbers to the

detailed call logs and answer questions such as, “Which customers have the greatest gaps and what are the root causes? Is a product change or rate-per-minute change driving this gap?” In addition, as users perform their analyses, they can save the new report results for future use and for sharing with other MicroStrategy users.

4.5 Cube Analysis Summary

While traditional MOLAP is often sufficient for limited departmental analysis domains, it fails to provide the power and flexibility required for true speed-of-thought analysis. MicroStrategy places analytic flexibility in the hands of business users – and frees up the IT department from creating and maintaining the cube data. With MicroStrategy, users can quickly add or remove report objects, modify report-filtering criteria, and create new metrics – all with easy drag-and-drop actions from any Web browser. MicroStrategy’s Intelligent Cubes let users perform report manipulations on cached data without accessing the database.

MicroStrategy delivers Cube Analysis by offering the new and revolutionary cube architectural paradigm of Intelligent Cubes, an analysis environment that is simple enough for novice users, yet powerful enough for power users wishing to perform transaction level analysis. In turn, the MicroStrategy architecture minimizes IT administrators’ workloads by eliminating the need to manage multiple cubes for different types of users, with varying security privileges and analysis environments. The MicroStrategy architecture automatically creates Intelligent Cubes that are built once and shared across the enterprise using the MicroStrategy architecture’s centralized metadata. Other BI software architecture is constrained by physical cube generation – and therefore cannot meet the demands of enterprise-class Cube Analysis.

MicroStrategy Intelligent Cubes do not inherit the disadvantages of pure MOLAP, cube-based BI tools. Cube-based BI tools offer limited data scalability, limited scope of analysis, and poor drill through to transaction level data. By contrast, MicroStrategy users performing Cube Analysis can analyze the full breadth of available data and are not limited by cube sizes. Through MicroStrategy Intelligent Cubes, companies can provide users with quick performance and full analytical power, while retaining the ability to report against terabytes of data at transaction level detail. With the cube-based architecture of other BI software, IT administrators must pre-calculate and pre-build the cubes prior to end-user access, resulting in cube storage in multiple, unlinked locations, requiring duplication of data for each location. With the MicroStrategy architecture, Intelligent Cubes are created automatically without IT assistance when users run a report – and are stored in the unified metadata on the centralized server.

MicroStrategy Intelligent Cubes save IT administrators’ time and hardware costs. Enterprises can consolidate separate cube, reporting and analysis systems into one integrated, scalable platform, and can distribute report and Intelligent Cube creation to power users, thus eliminating unnecessary maintenance work. With other BI architectures, administrators spend a substantial amount of time building and administering cubes because they must manually create, expire and refresh cubes constantly. With MicroStrategy,

Intelligent Cubes are automatically expired and refreshed on event- and time-based schedules.

MicroStrategy combines the speed and interactivity of MOLAP analysis with the analytical power and depth of ROLAP analysis. The following chapter explores ROLAP in the context of Ad Hoc Query and Analysis.

5

AD HOC QUERY AND ANALYSIS

Ad Hoc Query and Analysis is the Style of BI designed for information explorers and power users who need full investigative power against all enterprise data. These users require the ability to see any possible combination of data. If it were feasible to pre-design reports that covered every possible combination of data, then Ad Hoc Query and Analysis would not be needed. Practically speaking, this is impossible. Pre-defining reports with all possible permutations would require the design tens of thousands and even millions of reports depending on the extent of the database. It would also require the addition of hundreds or thousands of new reports each time a new attribute is added to the database.

The most basic way to support Ad Hoc Query and Analysis is to give users the ability to create brand new reports, allowing them to assemble any possible combination of data into a report. In that way, companies don't have to pre-design all possible report combinations. This is the basic definition of Ad Hoc Query and Analysis, and it is the method employed by most BI vendors. However, it is important to note that cube-based BI vendors only allow users to create ad hoc reports against the small subsets of data available in their proprietary cube databases. While this technically is an ad hoc report, it does not fulfill the requirements for full investigative analysis of the entire relational database.

The MicroStrategy architecture was designed from its very roots to provide the most robust Ad Hoc Query and Analysis capability in the industry. The MicroStrategy architecture allows users to create their own new ad hoc reports using the entire relational database as the source. MicroStrategy is founded on the Relational OLAP technology that allows users to perform full OLAP analysis against the entire relational database. The MicroStrategy architecture distinguishes itself from all other BI architectures in six key areas of Ad Hoc Query and Analysis application:

1. **Parameter-driven Reporting With Guided Analysis** – Allows users to create radically different reports simply by answering a series of questions (or prompts) just prior to running the report.
2. **Drill Anywhere** – Allows users to surf to any place in the database by using OLAP functionality and following the business model of the data warehouse.
3. **OLAP Analysis Against the Entire Database** – Allow users to conduct report manipulations.
4. **Sophisticated Filtering With Power of Sets** – Allows users to segment data according to

different business criteria in order to refine the data set.

- 5. **User-defined Data Grouping** – Allows users to refine the business model without causing any changes to the database or the overall business model.

The remainder of this chapter discusses each of these areas in detail.

5.1 Parameter-driven Reporting and Guided Analysis

Parameter-driven reporting functionality allows people to customize the content and layout of any given report within a range of variations defined by certain factors or parameters. The MicroStrategy architecture provides the richest range of parameterization available, allowing one report design to manifest itself in more variations than with any other BI technology.

Customizing Report Content Based on User Input at Run-time

With MicroStrategy, novice users can create sophisticated custom reports on the fly, defining report content by selecting metrics and business criteria at run time – simply by answering prompted questions. This allows enterprises to translate complex database query parameters into a set of simple questions that guide users (Fig. 27). For instance, users can select simple report elements such as a period of time equal to last quarter or a geographical area equal to the northeast.

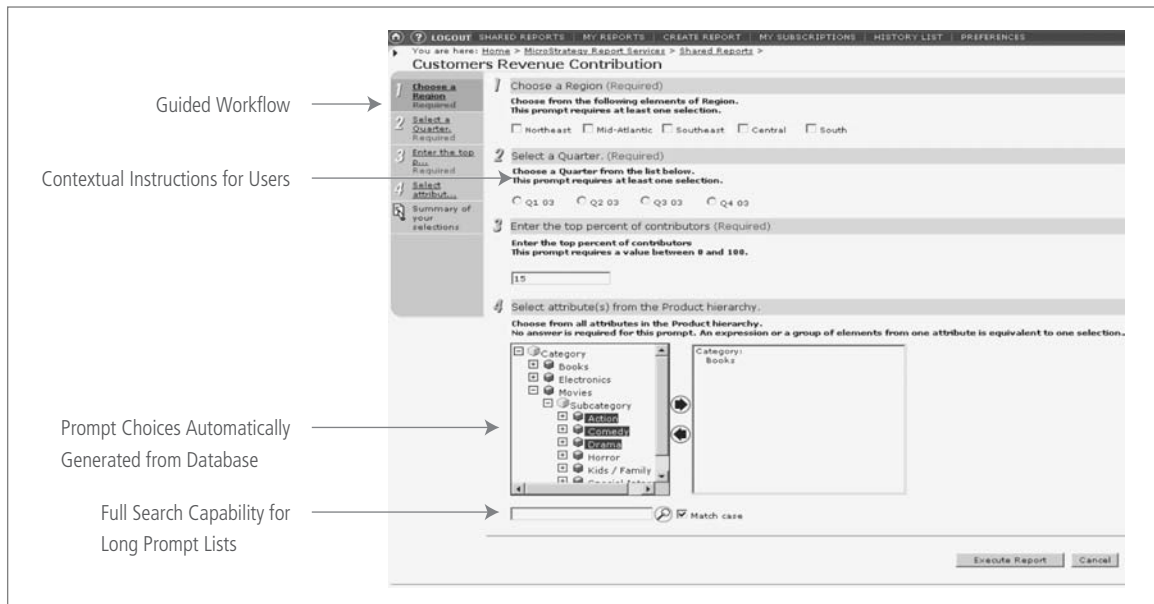


Figure 27 – MicroStrategy’s parameterized reporting allows users to re-run the same report with different parameter combinations, or inputs, as they refine their analysis and then save their sequenced answers for future use.

MicroStrategy parameterization, however, can be even more sophisticated. With MicroStrategy, users can request complex elements such as a “time period 90 days following a purchase” or a “geographical region

where market share growth is greater than industry average.” They can even customize the metrics within that data set. For example, MicroStrategy users can request the top 10% most profitable products by revenue or the routes with the highest standard deviation in total cycle time. The important thing to notice is that these requests refer to real business questions, not limited by database tables and keys and joins like other BI vendors’ technologies. This makes it easy and quick for users to customize report content.⁶

Ad Hoc Report Permutations By Varying User Inputs

What makes parameterized reporting truly useful is when the users have the ability to iterate quickly through many parameter sequences and to save their sequenced answers for future use. Users can re-run the same report with different parameter combinations as they refine their analysis. Furthermore, the basic analytical workflow is embedded in the parameter sequence as a series of hierarchical questions.

Once a user has identified a truly useful report based on a set of specific prompt answers, he or she can save that report with the prompts already answered in exactly the same way, thus generating a new ad hoc report. This lets each user save a full set of new reports that are simply useful pre-defined combinations of one parameterized report. Ultimately, through this process, the users get to decide which parameter combinations are useful through their actual day-to-day work, and can save the most useful combinations for future use and sharing across a workgroup or the enterprise.

Widest Range of Prompt Types Deliver Most Comprehensive Parameterization

MicroStrategy delivers the widest range of types of questions, or prompt types, which in turn give MicroStrategy parameterized reports the widest range of customizability at run time. There are four main types of prompts that can be used to create reports with MicroStrategy:

1. **Filter prompts** let users fine-tune the range of data set retrieved from the database and included in the report results. Filters can limit the range of business attributes and metrics, such as a filter that limits a report to sales greater than \$100 for the stores only in the northeast region. Filters can be created dynamically, saved, shared and reused in an almost infinite variety of ways, giving tremendous control to users in the form of filter prompts.
2. **Object prompts** let users select which fundamental elements will show up on a report. Thus, users can select the metrics, business attributes or Custom Group to be included in a report.⁷ This is an incredibly powerful prompt type: the list of possible metrics and attributes could be the full range of the data warehouse, giving a user the ability to create virtually any report. Object prompts can be even more complex than simply selecting metrics or attributes. For instance, an object prompt can include a choice of analytical functions, such as standard deviation, maximum, or average, and can be used in combination with another prompt that selects metrics to be combined with this function.
3. **Value prompts** allow users to input numbers, date values or text strings to be used within a report as part of a calculation, or as a threshold test, or simply as part of a title. The ability to input numbers is very useful for what-if analyses, in which users can change parameters at report run time and save the different reports as different scenarios, such as Best Case, Expected Case,

⁶ Refer to Chapter 3 (Section 3.2) for more information on MicroStrategy’s parameterized reporting capabilities. Figure 13 shows how MicroStrategy users answer prompts to define report contents from any Web browser.

⁷ Refer to Chapter 5 (Section 5.5) for information on Custom Groups and other User-Defined Data Groupings.

and Worst Case.

4. **Level prompts** allow users to control the aggregation level of the metrics on a report. For example, a user can choose at run time to calculate a product sales metric as a percent of total sales within a store, total sales within a region of many stores, or total sales of a country comprised of many regions – simply by setting the level prompt to be store, region, or country.

Minimizing the Total Number of Reports Needed

The flexibility of prompts significantly reduces the total number of reports necessary to develop and administer. MicroStrategy's advanced prompting capability allows a single report definition to be used by an unlimited number of users, with each user able to specify the exact data and format at report run time. For example, without MicroStrategy, reports of geographical sales data by region would need to be generated separately to satisfy different users. With MicroStrategy, report designers create one report that prompts the user at run time to choose report contents, such as quota performance below 50%.

5.2 Drill Anywhere Allows Users to Surf the Entire Database, Creating New Ad Hoc Reports Dynamically Through the Drilling Process

The MicroStrategy architecture is unique in the industry in its ability to Drill Anywhere in the entire database (data warehouse, datamart, or operational database). Only the MicroStrategy architecture, with its robust Relational OLAP foundation, makes the Drill Anywhere capability possible. Where other BI software limits users to drill up and down the hierarchies within their limited cube databases, MicroStrategy's unique ROLAP modeling of relational databases allows users to drill up, drill down, and drill across hierarchies anywhere in the entire database. Each drilling action creates a new report dynamically for the user. In essence, Drill Anywhere in the database gives users the ability to surf to the set of data that gives them the answers they are looking for without the need to manually create any ad hoc reports. This drilling and dynamic report generation is no less revolutionary than the Internet's ability to allow people to surf to any dynamically-generated Web page through hyperlinks, versus the pre-Internet manual method of explicit addressing and file transfers.

MicroStrategy users can surf the full range of enterprise data with an intuitive right-click drilling menu (Fig. 28). For example, they can drill from the quarterly regional sales to the customers' daily transactions at individual stores. From there, users can drill to the most profitable customers who shop in that particular store and to the products purchased by these profitable customers for cross-selling

Electronics Revenue vs. Forecast 2003						
Report		View		Data		Format
Autostyle: (Custom)						
1	2	3				
Region	Category	Subcategory	Quarter Metrics	Q1 03		
				Revenue Forecast	Revenue	
North	Electronics					
		Call Center				
		Employee		\$ 22,032	\$20,400	
		Country		\$ 34,110	\$34,110	
		More options...				
		Computers		\$ 8,501	\$7,523	
		Electronics - Miscellaneous		\$ 8,830	\$9,598	
		TV's		\$ 12,925	\$11,644	
		Video Equipment		\$ 31,046	\$32,680	
Mid-Atlantic	Electronics					
		Audio Equipment		\$ 26,028	\$25,770	

Figure 28 – Users can Drill Anywhere in the database with a simple right-click menu that allows you to drill up, drill down, or drill across to any other business attribute. A new report is dynamically generated as part of each drill operation.

opportunities. The process for moving down or up a hierarchy to more- or less-detailed data is commonly called drill down and drill up, respectively. The capability to shift to other hierarchies – for example, replacing customer with supplier – is called drill across. Collectively, the ability to perform any one or combination of drill down, drill up, and drill across actions – at any level of detail, anywhere in the database – is referred to as Drill Anywhere.

Guided Analysis with Drill Paths

MicroStrategy drilling also can be configured in such a way as to guide users along customized drill paths. These pre-designed drill paths lead users through a sequence of analysis, traversing along specific business attributes, business hierarchies, or to an entirely new report template altogether. The initial report can be used as a filter for a subsequent report in the drill path. For example, in a marketing campaign, a user can drill directly from a report that shows the list of customers who bought the twenty most profitable products to a new report that includes detailed contact and purchasing information for just these customers.

Minimizing the Total Number of Reports Needed

MicroStrategy’s sophisticated Drill Anywhere minimizes the number of reports that need to be pre-designed. With MicroStrategy, users can dynamically drill beyond their initial report to a wholly new report, which they can then save as a new standard report.

5.3 OLAP Analysis Against the Entire Database – On the Fly Report Manipulations

MicroStrategy users have the flexibility to modify reports on the fly by adding powerful subtotals, sorting on multiple values, paging by report attributes, pivoting the report axes, building new calculations or new derived metrics, applying sophisticated filtering criteria, using thresholds, and exporting data.

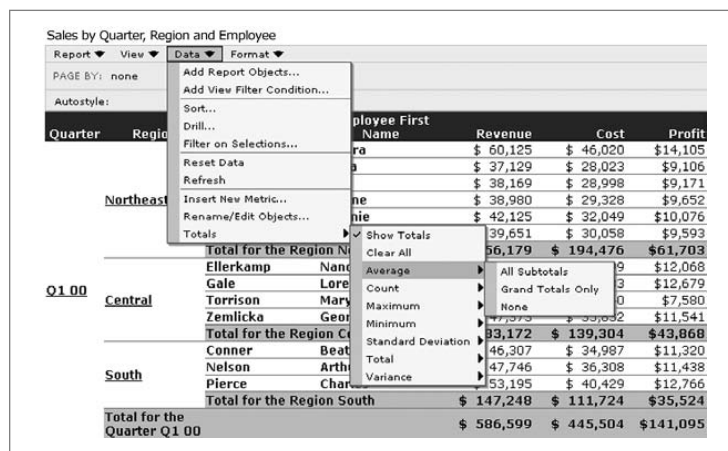


Figure 29 – MicroStrategy users can apply different types of totals and subtotals at levels of a report, using any analytical function from the MicroStrategy Library of functions.

Applying Subtotals to All Levels of a Report

Subtotals are data that are rolled up or aggregated according to some formulas for logical grouping levels that show up in a report (Fig. 29). For example, a regional report would have a total for the entire region and would have subtotals for all of the districts within the region. With MicroStrategy, users can apply subtotals using all types of functions available in the MicroStrategy Library, including sum, maximum, minimum, average, count, variance, and standard deviation, as well as custom functions. Subtotals can be applied on columns, rows, and across specific levels of business attributes in a report. With this feature, a person viewing a report with initial totals set at the region level for each quarter might then modify the report to calculate the total of all quarters for each region.

Multi-key Sorting, Page-by and Pivot Functions

A critical feature of any data investigation is being able to see the data in a new way, rearranging a report so that logical groups and progressions can be easily seen. With MicroStrategy, users can apply sorting to multiple columns in a hierarchical manner such that a person could sort on one column according to alphabetical ascending, then sort the remainders according to another column alphabetical ascending, and then sort these groups each by yet another column numerically descending (Fig. 30). Additionally, users can dynamically page-by business attributes in the report – for example, when reports display a large number of rows for sales, users can page by sales person to view individual performance one at time. Users can also pivot axes of a report – for example, moving quarter from a column to a row.

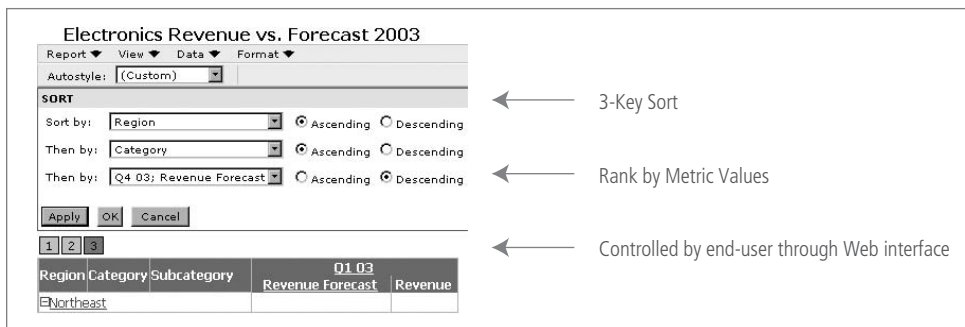


Figure 30 – MicroStrategy users can view the data from different perspectives and slice-and-dice large reports using pivoting, page-by, and multi-key sorting as shown here.

New Calculations and Filtering Criteria

New derived metrics can be calculated on the fly by combining existing metrics with arithmetic operators. For instance, a user can calculate a profit metric simply by subtracting cost from revenue in MicroStrategy's Metric Editor. In addition to viewing the profit results, the user can control the analysis process by sorting and filtering the report data using this new metric to view the products that generate the top 10% of profits. Business users can also use any report results as a filter for generating another report. For instance, a user can run a report that generates a list of products with profits exceeding \$20,000. Users can then use these results as a filter for a further report to be used in a promotional campaign to provide preferred customers, those who purchase the most profitable products, with an additional 15% discount.

5.4 Filtering Data Using the Power of Sets

Set analysis, also known as segmentation analysis, is effective across many business disciplines. It is particularly popular in marketing, where it generally takes the form of customer segmentation, through which an enterprise will segment the customer base according to different business criteria in order to find the right customers for certain products (Fig. 31). Set analysis is the process in which data sets are manipulated and combined to obtain a refined data set for further analysis. Set analysis functionality is a core strength of MicroStrategy, which takes advantage of all MicroStrategy platform capabilities and can be applied against the entire enterprise data warehouse.

Flexible Data Set Creation

Users can use set analysis to segment data into sets that reflect their particular business needs. This functionality creates a link between multiple business attributes and places a filter on that relationship. For example, users can identify customers who are over 50 years old, earn more than \$150,000 per year, and live in the northeast region but not in New York. Users can also create a report that compares the values of two metrics and then limit the set of data, for example, to view only products that have revenue greater than the previous year. Data sets can be personalized per user or shared with other users.

MicroStrategy's filtering capability is not limited to existing data definitions. It can be applied to new metrics created by users on the fly. For example, instead of filtering on the top sales representatives by dollars of sales, the user could use a filter that looked for the number of times they were in the top 10% of sales representatives over a period of time.

Integrated Set Analysis Functionality Uses Platform Benefits Such as Data Scalability and Analytical Richness

Other BI software may offer set analysis functionality, but only as a stand-alone tool. By contrast, MicroStrategy's set analysis functionality is fully integrated across all 5 Styles of BI. MicroStrategy users create data sets that are based on the full wealth of the enterprise data warehouse, querying and reporting on the data with all 5 Styles of BI. In addition, data sets can be extremely large in size. Only MicroStrategy sets can work against the entire database for the most accurate and insightful analysis.

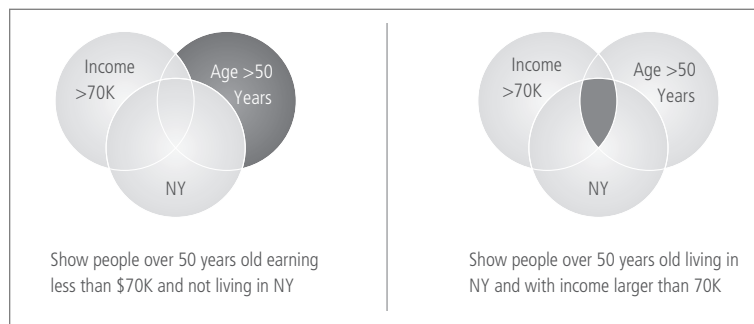


Figure 31 – MicroStrategy's set analysis functionality allows users to easily segment data based on their specific business requirements and using any analytical function.

5.5 User-defined Data Grouping

A data warehouse is organized in a structure that reflects the business model of an enterprise, but the structure does not always reflect the business needs of individual departments, teams and decision makers. As a result, users can have difficulty consolidating data into one report that meets their specific business needs.

MicroStrategy solves this problem with the unique features of Custom Groups and Consolidations. These are user-defined groupings of data that make sense to the users for a specific analysis or unique view of a problem. Custom Groups and Consolidations allow MicroStrategy users to define reports on a row-by-row basis (Fig. 32). Custom Groups and Consolidations provide tremendous flexibility to every department or individual to refine the business model. And because MicroStrategy shields the database from these user-specific and department-specific variations, there is no need to impose any changes to the corporate data model and business model.

Combining Multiple User-defined Groups With Varying Business Conditions In One Report

Custom Groups are made of business elements that make up the rows of a report. Users can define each report element separately from the other elements – each Custom Group element can act as a separate report with its own set of criteria, such as business attribute qualifications, metric qualifications, and banding qualifications. For example, users can define separate elements in a store inventory report. The first element includes stores with sales of less than \$50,000 and inventory of less than 100 products. The second element includes stores with sales of more than \$200,000 and inventory of more than 300 products. Users can also create a report that includes groups of stores based on the total profit they generate. For example, the first group includes the top 10% most profitable stores, the second group includes the top 11 to 20%, the third includes the top 21 to 30% and so on, with each group including a list of stores and their individual contributions.

Sales Customer Group	Metrics	\$ Sales YTD	\$ Sales
Products On Sale This Week		\$ 19,606	\$ 8,954
Brass Cigar Cutter		\$ 6,181	\$ 2,923
Elegant Writing Set		\$ 5,560	\$ 2,256
Fisherman's Reel Clock		\$ 4,630	\$ 1,906
WWI Trench Lighter		\$ 3,235	\$ 1,869
Top 4 Product Groups by Sales Contribution		\$ 43,621	\$ 14,323
Top 50% Product Groups by Sales Contribution		\$ 187,881	\$ 67,345
Bottom 10% Product Groups by Sales Contribution		\$ 5,724	\$ 1,856
Top 3 Brands by Division		\$ 11,920	\$ 4,563
Books - Bowles		\$ 2,265	\$ 1,006
Books - Brater		\$ 1,775	\$ 980
Books - Young		\$ 1,075	\$ 676

Figure 32 – MicroStrategy users can group unrelated items, with varying business conditions and levels of analysis, into a single report line. This is particularly useful for P&L-type reports where many line items are not at the same hierarchical level.

Applying Arithmetic Calculations Between User-defined Groups of a Report

MicroStrategy allows users to create virtual business attributes, known as Consolidations, which do not exist in the database and are specific to the business needs of the decision maker. Consolidations allow users to group different business attributes together in one row of a report and apply arithmetic calculations between these elements. For example, a user needs to calculate sales by season. However, the database does not include the business attribute season. With Consolidations, a person can group the various months that make up a season into four separate groups for the four seasons of the year. The summer season will include June, July and August; the fall will include September, October and November. In addition, users can perform row level math in any consolidation report such as multiplying or subtracting rows of a report. A user can create a new row that shows the difference between the top two most profitable months in spring. Consolidations can also include elements from different levels within the business hierarchy, such as item and subcategory in the products hierarchy, or from different business hierarchies, such as month and region in the time and geographic hierarchies. MicroStrategy's user-defined data groupings exist exclusively in the centralized metadata and therefore are centrally administered and secure.

Other BI software require the user to export a report to a spreadsheet, write a macro to sift through the data then group and band the report. This exporting approach may work for a single user, but the consistency of the results can't be guaranteed anywhere else across the enterprise. In addition, it has been shown again and again that off-line programming of spreadsheets and databases can have a severe, negative impact on job learning, as new employees have difficulty finding and understanding all of the hand-made and often idiosyncratic mechanisms for analyzing and reporting data.

By contrast, MicroStrategy's user-defined groupings satisfy specific users needs and do not change the database structure or business model. Users can create their own groupings of data regardless of the database structure and without assistance from report designers or administrators. This greatly minimizes the maintenance work of administrators, ensures the consistency in database structure and data, and satisfies the needs of end-users. MicroStrategy's user-defined data groupings are yet another way to reduce the effort and cost of BI while making people more effective, better able to respond to one-off situations and quicker to adapt to new business situations.

5.6 Ad Hoc Query and Analysis Summary

Ad Hoc Query and Analysis – the ability to ask questions about the data underlying a standard report – is an important capability that allows users to explore their data without administrative intervention. In an Ad Hoc Query and Analysis environment, business users can generate new or modified reports with control over content, layout and calculations. MicroStrategy provides users with an abstraction layer that allows them to investigate raw enterprise data in business terms they understand. The users do not need to understand databases, table structures, or query languages – they only need to know how to point and click. They can drill into their data to access detailed information guided by their business model, not their database model. By contrast, BI software that requires knowledge of query languages or the structure of databases never

proliferates in an organization because only very few users ever become proficient with them. MicroStrategy uniquely provides a centralized abstraction layer coupled with powerful multi-pass SQL generation. The MicroStrategy architecture provides the conduit between the information needs of business users and the underlying power and scale of relational databases.

With MicroStrategy, users have complete Ad Hoc Query and Analysis capabilities – from parameter-driven reporting, to Drill Anywhere, to OLAP analysis against the entire database, to set analysis, to user-defined groupings. MicroStrategy users with little or no training build reports simply by answering straightforward business questions. They perform ad hoc analysis, drilling down to the deepest level of information or drilling across to new hierarchies anywhere within the enterprise database. Using any Web browser, MicroStrategy users can slice-and-dice data, page by business attributes, pivot data between columns and rows, filter data on the fly to refine the data set, and sort and rank data to arrange it in a format that yields the most insight. Additionally, business users can calculate new ratios, determine variances, and create user-defined groupings that do not exist in the database. The ad hoc reports can be saved for future use or for sharing with other users internal and external to the enterprise.

Giving end-users this level of control over their data minimizes the administrative workload and reduces costs. With the MicroStrategy architecture, administrators can build once and deploy throughout the entire enterprise, enabling users to then build exactly what they want when they need it.

6

STATISTICAL ANALYSIS AND DATA MINING

Statistical Analysis and Data Mining is targeted at professional information analysts, individuals who regularly perform correlation analysis, trend analysis, and projections. This advanced Style of BI is achieved by applying mathematical, financial and statistical functions against enterprise data.

The business insight derived from Statistical Analysis and Data Mining is critical for every enterprise. However, specialized data mining tools are difficult to use – only statisticians with technical training are able to use them. Instead, MicroStrategy’s BI technology was designed specifically to deliver much of the common functionality of data mining tools – and to deliver it in a way that is familiar and consistent with everyday business intelligence usage.

MicroStrategy’s Statistical Analysis and Data Mining features include the following five key areas:

1. **Applying Statistics and Data Mining Against The Entire Database** – Allows users to pick from more than 200 mathematical, OLAP, financial, and statistical functions to apply against the entire database for more accurate results.
2. **Plug-and-Play Architecture for Custom Analytical Functions** – Allows companies to extend the analysis with calculations that are customized to its business.
3. **Seamless Integration with Data Mining Tools** – Allows the melding of mainstream BI with the more arcane science of data mining.
4. **Sophisticated Collaboration Technology** – Leverages analytic functions of relational database management system when present and otherwise supplements with analytic functions of MicroStrategy Analytic Engine.
5. **Multi-pass SQL** – Lets users perform any type of analysis – from pricing optimization to rankings and contributions – not possible with single-pass SQL.

The remainder of this chapter discusses each of these areas in detail.

6.1 Applying Statistics and Data Mining Against the Entire Database and for All Users – Using MicroStrategy’s Comprehensive Library of Statistical and Mathematical Functions

The application of more advanced analytical functions is too often a disconnected process and usually applied to only subsets or summaries of data. With other BI software, business users depend on an administrator or a developer to apply the analytical function or model against their specific set of data. Users then frequently have to ask to have new functions applied to further clarify and analyze data. This process is slow and inefficient for both users and administrators.

The quality of the insights gained from a Statistical Analysis or Data Mining application is directly related to the quality and completeness of the underlying data. If the application is not able to access all of the data needed to build a model, then even the most complex mathematical model will give misleading or incorrect results. This issue is made more difficult given that database sizes have been growing exponentially over the last decade, and valuable information is buried within this growing mass of data.

MicroStrategy users can apply any of over 200 mathematical, OLAP, financial, and statistical functions against the entire volume of data collected in the enterprise data warehouse. The MicroStrategy architecture accomplishes this through its highly sophisticated SQL Generation Engine as well as by its specialized Analytic Engine that supplements the database’s calculation capabilities.

By contrast, other BI technologies have far fewer native functions than MicroStrategy, and those functions can only be applied to the limited data volumes present in proprietary cube databases. Due to their inherent data limitations, cube-based BI architectures are incapable of providing a comprehensive picture of the inter-relationships of data across the enterprise.

For example, telecommunications and financial services enterprises log millions of records every day. These enterprises can only gain insight into their records if they can directly access the transaction level data. One MicroStrategy telecommunications customer discovered new insights into customer calling patterns, resulting in cost savings of tens of thousands of dollars every month. This level of analysis and subtlety of insight could not be detected in the usual aggregated monthly analysis typical of cube-based BI tools.

More than 200 Analytical Functions Available Out-of-the-Box in the MicroStrategy Library to Support All Types of Analysis

With MicroStrategy, users can pick from more than 200 mathematical, OLAP, financial, and statistical functions (Fig. 33). Users then can apply these functions on the fly to any set of enterprise data without any administrative help. These functions range from simple database concepts such as running totals, to full **Mathematical functions** such as sum, count, average, correlation, slope, and standard deviation; to **OLAP functions** such as rank, running sum, and exponential moving average; to **Financial functions** such as internal rate of return and accrued interest; and to **Statistical functions** such as chi-squared and exponential distributions, kurtosis, skew, and t-tests, among a host of others.

<p>TYPICAL ANALYTICS FOR REPORTING</p> <p>Basic Average Mean Count Sum Maximum Minimum Median Mode Product Rank Percentile N-Tile N-tile by Step N-tile by Value N-tile by Step and Value</p>	<p>Standard Deviation of a Population Variance Variance of a Population Geometric Mean Average Deviation Kurtosis Skew</p> <p>Math Absolute Integer A-cosine Ln Hyp A-cos Log A-sine Log10 Hyp A-sine Mod A-tan Power A-tan2 Quotient Hyp A-tan Radians Ceiling Randbetween Combine Round Cosine Sine Hyp Cosine Hyp Sine Degrees Square Root Exponent Tan Factorial Hyp Tan Floor Truncate</p>	<p>Cumulative Principal Paid on Loan Depreciation for each Accounting Period Days In Coupon Period to Settlement Date Days In Coupon Period with Settlement Date Days from Settlement Date to Next Coupon Double-Declining Balance Method Discount Rate For a Security Effective Annual Interest Rate Fixed-Declining Balance Method Future Value Future Value of Initial Principal with Compound Interest Rate Interest Payment Internal Rate of Return Interest Rate per Annuity Macauley Duration Modified Duration Modified Internal Rate of Return Next Coupon Date After Settlement Date Number of Coupons Settlement and Maturity Date Nominal Annual Interest Rate Number of Investment Periods Net Present Value Odd First Period Yield Odd Last Period Prev Coupon Date Before Settlement Date Price Per \$100 Face Value with Odd First Period Payment Payment on Principal Price Price Discount Price at Maturity Present Value Prorated Depreciation for each Period Straight Line Depreciation Sum-Of-Years' Digits Depreciation T-Bill Price T-Bill Yield Variable Declining Balance Yield Yield for Discounted Security Yield at Maturity</p>	<p>Statistical Beta Distribution Beta Inverse Binomial Distribution Probability Chi Distribution Chi Inverse Chi Test (Independence) Confidence Correlation Coefficient Covariance Critical Binormal Distribution Cumulative Binomial Distribution Exponent Distribution F-Probability Distribution F-Test Fisher Transformation Gamma Distribution Gamma Inverse Gamma Logarithm Homoscedastic t-Test Heteroscedastic t-Test Hypergeometric Distribution Intercept Point Inverse of Lognormal Cumulative Distribution Inverse of F Probability Distribution Inverse of Fisher Distribution Inverse of the Std Normal Cumulative Distribution Inverse of the t-Distribution Lognormal Cumulative Distribution Mean t-Test Negative Binomial Distribution Normal Cumulative Distribution Normal Distribution Inverse Number of Permutations for a Given Object Paired t-Test Poisson Distribution Pearson Product Moment Correlation Coefficient RSQ (Square of Pearson) Slope of Linear Regression STEYX (Standard Error of Predicted "y" Value) Standardize Standard Normal Cumulative Distribution t-Distribution Variance Test Weibull Distribution</p>
<p>ADVANCED ANALYTICS FOR REPORTING</p> <p>OLAP Running Total Running Standard Deviation Running Standard Deviation of Population Running Minimum Running Maximum Running Count Moving Difference Moving Maximum Moving Minimum Moving Average Moving Sum Moving Count Moving Standard Deviation Moving Standard Deviation of Population First or Last Value in Range Exponential Weight Moving Average Exponential Weight Running Average</p> <p>Statistical Aggregate Standard Deviation</p>	<p>Financial Accrued Interest Accrued Interest Maturity Amount Received at Maturity Bond-equivalent Yield for T-Bill Convert Dollar Price from Fraction to Decimal Convert Dollar Price from Decimal to Fraction Cumulative Interest Paid on Loan</p>		

Figure 33 – MicroStrategy provides users with more than 200 statistical, mathematical, OLAP and financial functions out of the box.

MicroStrategy users can perform analysis ranging from the simple to the advanced. For example, users can better understand how customers spend their money by answering questions such as “What is the median spending of customers in each customer region?” and “What is the standard deviation of all customers’ spending in each region?” or “What is our market share growth this year by store, for those stores where actual sales exceeded target sales by more than 15%?”

The ability for any user to perform these analyses on the full range of enterprise data is critical. Other BI software allows only limited analysis on extracted subsets of data in cubes. With MicroStrategy, users themselves can choose to subset data using filters and then perform further analysis by applying mathematical, OLAP, financial, and statistical functions from the MicroStrategy Library. Using these functions, MicroStrategy users can perform market basket analysis, churn prediction, retention, risk, deciling, and hypothesis testing, as well as data mining techniques such as forecasting and clustering.

Consistent Analytical Power in the Hands of All Users and Against the Full Wealth of Enterprise Data

MicroStrategy allows all users to drag-and-drop any analytical function onto any enterprise data set. With other BI software products, which have cube-based architectures, users access data on their desktops – this data can become outdated and often differs from user to user, department to department, and server to server. Calculations based on data stored in cubes are inaccurate and incomplete since they are applied only on a subset of the enterprise data. By contrast, the MicroStrategy architecture allows users to apply analytical functions or hypothesis testing to any data set in the enterprise data warehouse, with calculations defined and stored centrally in the metadata – ensuring consistency, accuracy of calculations and easy access by disparate users. Consequently, MicroStrategy users can rely on their data and focus on their creativity and job expertise to unlock value for the enterprise. The MicroStrategy architecture uses a centralized abstraction layer – a unified metadata across all 5 Styles of BI – that guarantees consistent function and metric definitions across the enterprise.

6.2 Plug-and-Play Architecture for Custom Analytical Functions

Many enterprises have unique and proprietary calculations that are needed because of the unique and proprietary character of their business model. Whether it’s some unique calculation of productivity, or a unique correlation formula relating sales to promotions, or heuristic price elasticity coefficients, or some unique predictor of fraud probability, all companies have some business calculations that are not simply standard mathematical functions. Interestingly, these also tend to be some of the most critical business questions that a BI system should be able to address. This is where custom analytic functions become very important.

MicroStrategy’s Extensible Architecture For Plugging in Custom-built Functions

The MicroStrategy architecture is open and extensible, allowing enterprises to create their own custom analytic functions, and embed those functions in any BI report or analysis (Fig. 34). MicroStrategy accom-

plishes this using a step-by-step Plug-In Wizard to make it simple for average people to create new analytics for the enterprise or their workgroups. Once a custom analytic function is added to the MicroStrategy Library, it can be used just like any other function. Users do not need to learn multiple tools to achieve their analysis goal.

Centralized Metadata Ensures Consistent Definition of Any Analytical Function Across The Enterprise

Functions from the MicroStrategy Library are stored alongside other objects in one central metadata location that all users access. MicroStrategy’s architecture ensures that analytical functions’ definitions are standardized across the enterprise. For instance, a newly added profitability function will have the same underlying definition across the enterprise. By contrast, with cube-based BI tools, users can have varying definitions of the same function or metric on every different cube because each cube is independent of the others. With MicroStrategy, users safely share functions through the centralized metadata, relying on the same underlying definitions and data.

Single Development Environment For Simple, Advanced, and Custom Analytical Functions

With most BI software architectures, report designers need to use multiple tools to shift between simple analysis and advanced analysis. Some power users might even use specialized data mining tools for advanced statistical analysis and custom functions.

More importantly, separate analysis tools typically imply separate and distinct data stores. One analysis tools works against the full data warehouse, whereas another tool works against a data subset that has been re-calculated and summarized into a cube database, while a third data mining tool requires a data extract loaded into proprietary data format. The need to extract, transform and load data from the data warehouse into purpose-built, proprietary structures optimized for one tool is an expensive process to build and a very expensive process to maintain. Moreover, separate analysis environments add additional layers of complexity to the enterprise’s overall technology architecture. The net effect is a slowing of enhancements and an increase in the chance for error.

By contrast, MicroStrategy’s architecture lets users perform Statistical Analysis and Data Mining in-place – in a unified environment from the same interface – and therefore represents a huge step forward in BI. With MicroStrategy, report designers operate in one single user environment for analysis using simple, advanced and custom functions; this minimizes the report designers’ workload, as well as errors caused by having multiple incompatible tools.

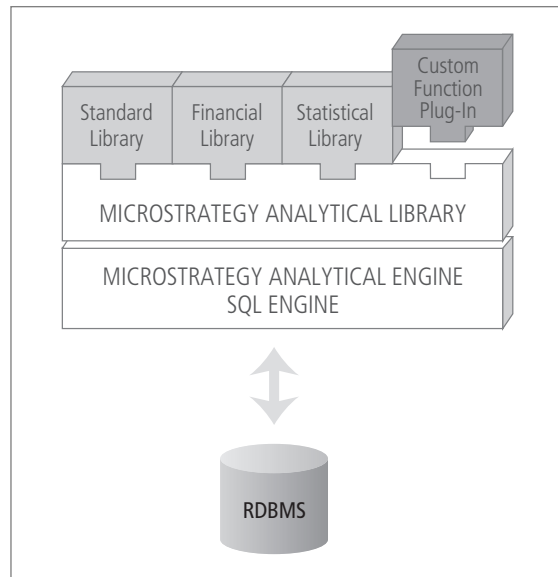


Figure 34 – Enterprises can easily add custom functions to the MicroStrategy Library. Once the custom function is added, it can be used in any MicroStrategy report or analysis.

6.3 Seamless Integration with Data Mining Tools

The main purpose of data mining is to discover patterns and algorithms in the existing data that can be used to predict future outcomes. This includes analysis techniques such as regression, segmentation, clustering, and forecasting. Typically, whenever business users need sophisticated predictive functionality, they must contact a highly skilled developer to assist with their request using a formal data-mining tool. Mathematicians, statisticians and administrators then “discover” the appropriate algorithms using data-mining tools along with a subset of the actual data by “training” the data-mining tool. Unfortunately, a recurring problem with this basic model is that each analysis tends to be a one-time event. That is, the new algorithms are not generally available to all users through their standard BI reporting or analysis system – instead the separate data mining processes delivers a series of one-time answers to the requester.

Integration With Existing Best-of-Breed Data Mining Technologies

Because the MicroStrategy architecture supports customized analytic functions to be inserted into the standard MicroStrategy Library, it can easily incorporate the highly specialized data-mining algorithms generated by best-of-breed data mining products (Fig. 35). The diagram below shows how this works with MicroStrategy and any data-mining product that adheres to the new Predictive Modeling Markup Language (PMML). In this scenario, the MicroStrategy architecture delivers a subset of data to the data-mining tool to perform its algorithm creation process. Once complete, the algorithm is shipped back to MicroStrategy to be inserted directly into the MicroStrategy Library. At that time, it is available to any report or user who wants to use it. If the algorithm exceeds the capabilities of MicroStrategy’s Analytic Engine, as in the case of neural network algorithms, then MicroStrategy calls the best-of-breed data mining tool to assist in the calculations.

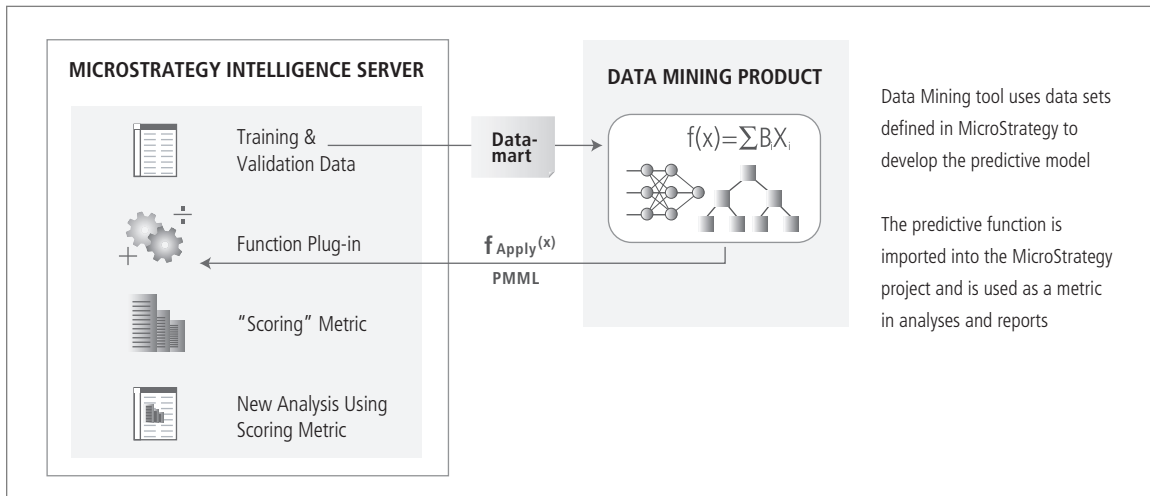


Figure 35 – MicroStrategy Intelligence Server integrates seamlessly with best-of-breed data mining products by importing the data mining algorithms directly into the MicroStrategy Library, so that the data mining analysis capabilities can be incorporated into any MicroStrategy report.

In this way, highly specialized algorithm developers can develop reusable libraries of data mining functions that are accessible to everyday MicroStrategy reports.

All Users Can Take Advantage of Data Mining Models Without Learning Their Complexities

With data mining algorithms integrated in the MicroStrategy architecture, business users can access data mining calculations for everyday business analysis. Users can use these models to answer questions like, “Which customers are likely to switch to the competition in the next 6 months,” without needing to learn the complexities of the models.

One illustrative example of optimal integration of BI and data mining is in the area of marketing campaign management. In this example, a business user creates a report with pertinent customer demographics such as age, gender, income, education, household size and success rates with prior marketing campaigns, using Ad Hoc Query and Analysis, and sends that data to the data mining tool as a small data-mart. The data mining tool identifies a predictive algorithm that indicates the likelihood of various customer profiles to respond positively to various marketing campaigns. This predictive algorithm is inserted into the MicroStrategy platform and is applied to the entire database of customers to determine precisely whom to include in the marketing campaign and the expected results.

6.4 Sophisticated Analytic Collaboration with Relational Databases

The MicroStrategy Analytic Engine operates collaboratively with the calculation engines embedded in the relational database management system (RDBMS). Not all databases have the same calculation capabilities. There are some important analytical functions that some databases simply do not support and other analytic functions that database systems cannot do quickly. To overcome this, the MicroStrategy Analytic Engine automatically compensates for variations in calculation capabilities of the different database systems – allocating calculation responsibilities to the database system when it can be best done in there, and reserving the calculation for MicroStrategy when the database system can not accomplish it quickly.

Proprietary Collaboration That Answers Users Requests Not Otherwise Possible

The MicroStrategy architecture collaborates with database technology in an intelligent and proprietary multi-step interaction process. The main benefit of this multi-step process is that it can provide answers to queries that cannot be answered by the database itself, such as user-defined groupings, Custom Groups, Consolidations and other analytical functions not supported by the database. Complex questions that cannot be answered with other approaches or that require multiple BI tools can be answered quickly and easily with MicroStrategy. With most BI software, administrators have to perform a manual process to answer user requests when the database does not support the required analytical function. By contrast, MicroStrategy users’ requests are answered automatically, without an IT administrator’s intervention. For example, MicroStrategy users can use functions like Chi-squared distribution even if the database does not support it.

Support For All Available Functions Regardless Of Database Platform

When connected to database platforms such as Oracle, IBM, Teradata or SQL Server, MicroStrategy automatically recognizes the database type and loads the appropriate list of supported functions. When

users run analytical reports, MicroStrategy automatically calculates the results either inside or outside of the database, depending on the list of supported functions. Market basket or product affinity questions, for instance, are natural inquiries in a business setting, but extremely difficult to support with other BI software. A question like, “For all customers who bought the roadside assistance plan, what are the five other options most likely to be purchased for the same vehicle,” simply cannot be handled by a cube-based BI tool. MicroStrategy makes use of automatic collaboration to overcome database limitations, easily constructing the analysis at the moment it is requested, with whatever variations are desired. An inquiry like, “For any car dealers that belong in the top three deciles in sales any month in the last year, return the contact information for those who fell out of the top three deciles last month,” is answered automatically by MicroStrategy.

The MicroStrategy architecture allows for seamless collaboration between the enterprise data warehouse and the MicroStrategy platform, taking into account not only the specific database platform, but also its version. MicroStrategy uses native database functions where they exist and supplements with functions native to or plugged into the MicroStrategy platform, thereby allowing the most complicated analyses to be constructed and executed with ease.

6.5 Multi-pass SQL Produces Calculations Not Otherwise Possible

Many normal business questions – those that any business user would likely ask if not constrained by the limits of a tool – simply cannot be answered with single-pass SQL. That’s why the MicroStrategy SQL Generation Engine is optimized for multi-pass operation.

Most people would agree that there are sophisticated questions that imply complicated kinds of analysis requiring multi-pass SQL, like dynamic pricing decisions or logistics optimization problems. However, it is surprising to many people that there are many cases of business questions that are deceptively easy to ask, but which can be extremely difficult or impossible to answer without the use of multi-pass SQL.

Take, for example, ranking and contributions. There are two ways to accomplish these simple-to-ask queries; either by bringing all data back to a cube database in an offline data aggregation process, or by generating multi-pass SQL that bring the results immediately to the user. The former method, employed by other BI software, can have severe consequences in terms of query latency and network traffic. The latter method, employed by MicroStrategy, is optimal. MicroStrategy generates multi-pass SQL, breaking the user’s query down into a number of simple queries that are processed separately by the database and then automatically grouping the results of the separate queries. This multi-step processing can even be performed in parallel, to the extent that the database is configured to optimize and parallelize these queries as they arrive.

Multi-pass SQL is the only way to derive answers to questions that involve rankings and contributions. To identify the relative rankings in a campaign of the top ten salespeople in the northeast region, for exam-

ple, the multiple SQL passes are: compute the performance of every salesperson in the campaign, compute the year-to-date sales of every salesperson in the northeast region, rank the salespeople, filter out all but the top ten, and then rank them relative to the campaign.

Calculations such as product affinity or market basket analysis are very difficult or impossible to do using other BI software. Cube-based BI architectures are limited in their analytical reach by their inability to create multi-pass SQL. For example, cube-based BI tools would solve the simple question, “Show me all the customers and their sales transactions for customers who spent more than \$1,000 last year,” with administrators pre-building cubes grouped by the criterion “\$1,000 last year,” thus hard-coding the time period and amount and vastly limiting the range of analysis. Most BI software cannot calculate market basket analysis, such as, “Show me the top 10% most profitable customers who bought televisions but did not buy a DVD player.”

Answers to a broad range of seemingly innocent queries can only be achieved with multi-pass SQL, where each pass represents a sub-query necessary to calculate the final result. Cube-based BI tools lack the ability to generate multiple passes of SQL and therefore either cannot support the calculations or must apply calculations after all the data is returned to the user’s desktop. This limits not only the types of analyses, but also the size of data sets and the number of columns used in the calculations. By contrast, MicroStrategy generates optimized multi-pass SQL to perform these calculations in the quickest and most effective way possible by taking advantage of the database’s strengths.

Automatic and Optimized Generation of Multi-pass SQL

MicroStrategy generates multi-pass SQL that is optimized for the specific database being used, enabling the use of all of the database-supported analytical functions and algorithms. MicroStrategy’s unique multi-pass SQL generation capability can produce thousands of lines of perfect code in under a second.

The volumes of data in today’s data warehouses are too great to be examined directly. For decision-makers to draw valuable insights, or business intelligence, as they develop new business strategies and implement them, the information has to be culled and manipulated in various ways. Looking at summaries and drilling within data subsets or cubes are sufficient for some analyses, but cannot bring the same level of insight and exposure of certain truths yielded from tapping into the entire database. These hidden or latent truths can take the form of trends, patterns, and anomalies in the data.

6.6 Statistical Analysis and Data Mining Summary

In the past, organizations used specialized data mining tools to supplement other BI software. Cube-based BI tools not only lack the advanced analysis capabilities necessary to support Statistical Analysis and Data Mining, they are not architected to address very large data volumes at all. In addition, few statisticians are trained to use data mining tools, forcing the majority of business users to wait for assistance to answer their questions. This process is both inefficient and costly, requiring two different software products – BI and data

mining. BI tools and data mining tools typically are not compatible, access different data sets, and can only be used by a handful of very skilled users. In addition, the results cannot be consistent if they come from tool sets with separate business definitions, independent ETL processes, or different data structures.

The MicroStrategy architecture is unique in its ability to overcome these problems, supporting a full range of Statistical Analysis and Data Mining techniques accessible to all users from the unified Web interface. Both advanced and novice users can use the comprehensive MicroStrategy Library and benefit immediately from MicroStrategy's unique multi-pass SQL generation. Enterprises can also plug in their own custom-built functions to extend the advanced analysis range of MicroStrategy. Additionally, MicroStrategy allows enterprises to fully integrate with existing third-party data mining tools. Furthermore, the MicroStrategy architecture allows users to apply Statistical Analysis and Data Mining techniques on the fly against the entire enterprise data warehouse.

7

REPORT DELIVERY AND ALERTING

Report Delivery and Alerting is the Style of BI designed to proactively distribute large numbers of reports and alerts to potentially very large populations of information consumers – both internal and external to the enterprise. With such a broad mandate, Report Delivery and Alerting must be highly flexible and functional.

Most BI vendors offer products that support a minimal form of Report Delivery and Alerting. That is, most BI vendors offer products that can centrally distribute emails to large user populations, with report enclosures, and on a scheduled basis. The MicroStrategy architecture also supports this minimal functionality, but further distinguishes itself by supporting an additional four key areas:

1. **Report Distribution Through Any Touchpoint** – Email, Printers, File Servers, and Portals
Using HTML, Excel, RTE, PDF, and ZIP containers to carry the report content.
2. **Self-subscription as well as Administrator-based Distribution** – Allowing companies to mix centrally-mandated report distributions with individually-driven information needs.
3. **Delivery On-demand, On-schedule, or On-event** – Triggering the report distribution through whatever means are most appropriate to the user.
4. **Automatic Content Personalization** – Making the report more relevant and secure for all users.

The remainder of this chapter discusses each of these areas in detail.

7.1 Report Distribution Through Any Touchpoint

MicroStrategy reports can be automatically distributed through the widest range of user touchpoints on the market, including email, Web browsers, networked printers, networked file servers, and corporate portals.

With **email distribution**, MicroStrategy can display the report contents directly in HTML, or can enclose the report as an attachment in the form of an Excel, Rich Text Format (RTF), or Portable

Document Format (PDF) file. And with MicroStrategy, these attachment files can automatically be zipped and password protected.

With **networked printer distribution**, reports can be sent directly to networked printers around the world automatically. The report is formatted in the print-perfect PDF format and sent to all of the printers defined by each recipient user's preferences.

With **networked file server distribution**, MicroStrategy can distribute reports directly to archival file servers anywhere on the network. With each new file distribution, the system can automatically create new archive folders, thereby allowing companies to keep a historical record of all standard reports.

With **corporate portal distribution**, MicroStrategy can distribute reports directly to Web portals. This allows companies to concentrate all information publishing and consumption on their corporate portals, thereby offering a one-stop-shop for all standard company information.

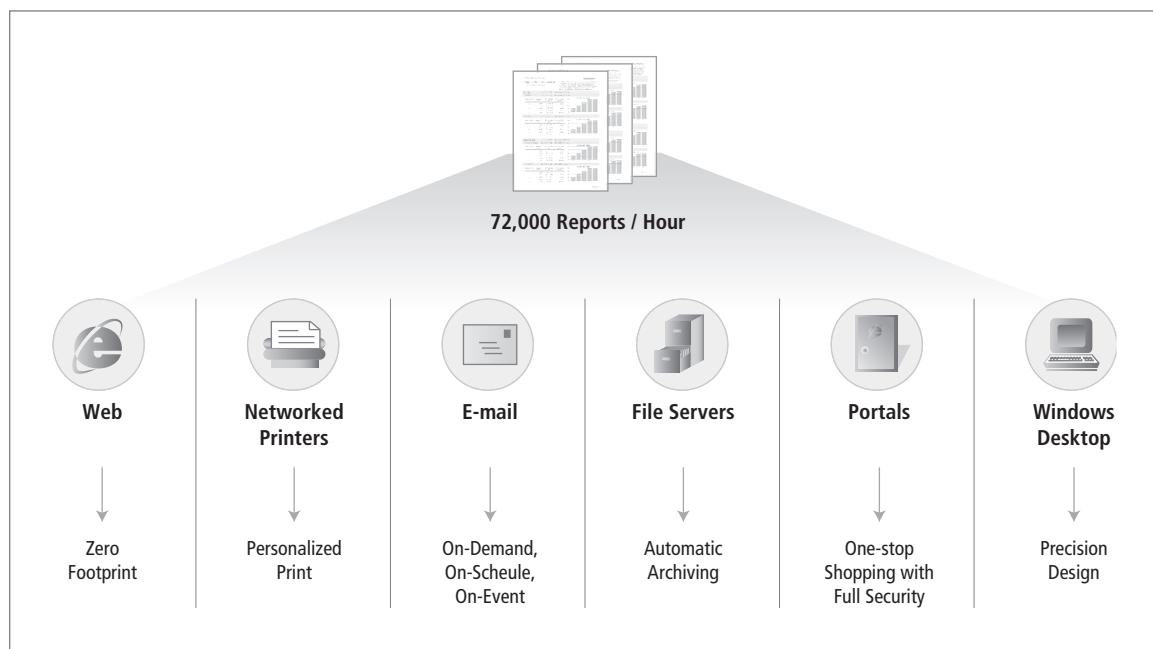


Figure 36 – The MicroStrategy architecture can distribute high volumes of reports through any touchpoint of the individual's choosing automatically.

7.2 Self-subscription as well as Administrator-based Distribution

All competent Report Delivery and Alerting technologies are able to distribute reports when a central administrator manages the entire distribution process. In this case, the central administrator establishes all distribution services and assigns all users to receive various reports at various times. Any user who wants to be included in a weekly report distribution contacts the central administrator and requests to be

put on the distribution list. Obviously this model has severe practical drawbacks as the number of users gets very large, as each user has a different distribution profile, and as users continually add and delete reports from their distribution profile. The central administrator becomes the central bottleneck.

MicroStrategy avoids this problem by also allowing users to self-subscribe to reports – without the need for any administrator intervention. This eliminates the dependence on a central administrator and allows users to continually change which reports they want to receive and when. With MicroStrategy, end users even have the ability to subscribe other end users to receive reports too, so a manager can subscribe her subordinates to receive a weekly report that she deems important for her group.

Self-subscription over the Web with MicroStrategy greatly reduces administration costs while enabling applications to be deployed to extremely large user communities. For example, an IT administrator can create one parameterized report and instantly deploy it to all users, letting each user customize the report with his or her own parameters instead of designing and sending unique reports individually to each user. Moreover, centrally maintained MicroStrategy security profiles ensure that users do not receive any information to which they are not entitled.

7.3 Delivery On-demand, On-schedule or On-event

MicroStrategy users and administrators have complete control over the timing of all their report distributions. In the simplest case, users and administrators can establish a periodic distribution for any report (**on schedule**), such as every Monday morning at 8:00 AM, or every other Tuesday, or the first Friday of every month. In addition, users can establish subscriptions for themselves as well as establish them for other people as long as they have the security privilege allowing them to do so.

Users also have the ability to distribute a report to others immediately (**on demand**). In this scenario, a user freely can customize a report with pivoting, page by, drill anywhere, etc. and then immediately send that report result to any other user of the system. The recipient will see exactly the report that the sender saw prior to sending

Finally, MicroStrategy report distributions can be triggered based on an event that occurs in the database itself (**on event**). This might include new data being loaded into the database or even something as precise as a metric in the database exceeding some pre-established threshold value. The event-based distribution capability is critical for real time alerting applications.

The MicroStrategy architecture can monitor KPIs, or analytical indicators, based on business rules, sending an alert to the decision maker as soon as an indicator reaches its pre-defined threshold or condition level. Users can subscribe to alerts based on any event criteria of their choice. In retail, for example, a store manager can receive an email alert when the inventory of DVDs goes below 20% of regular weekly demand, with a reorder button that connects her directly to suppliers.

The Alerting functionality is crucial for uncovering problems with high impact risk but low probability of occurrence. For instance, in a manufacturing process, defects caused by malfunctioning components can occur anywhere in the assembly line. As soon as the quality system locates a defective component, the floor manager gets an alert with the details and a set of actions to fix it. This eliminates the enormous costs of recall and reassembly, not to mention improved customer satisfaction. The Alerting capability allows decision makers to fix small issues before they become major problems for the enterprise.

One of the top financial companies in the United States uses MicroStrategy to alert their Client Relationship managers via email when their clients have made a large deposit. This enables them to get in touch with individual clients in a timely manner and offer financial services before that money is spent elsewhere. In another application, one of the world's leading disk-drive manufacturers uses MicroStrategy to alert the appropriate plant manager if one of the parts they use to build disk drives is faulty. This minimizes the length of the affected run and allows plant managers quickly to choose an alternative, thereby preventing the production of drives that would need to be fixed or recalled from customers.

In all cases, MicroStrategy users manage their distribution profiles and preferences directly from the Web interface (Fig. 37). Users can define distribution triggers and delivery touchpoints for any given report distribution service. Additionally, users can specify their language of choice, time zone, and currency setting.

Select the schedule, address, delivery format, title and personal message, from the Web and for any report

Monthly Revenue Growth by Distribution Center

Report View Data Format

Autostyle: Finance

SCHEDULED E-MAIL

You have 0 subscription(s) to this report that will be delivered by e-mail.

Select a schedule from the list below. Choose an address

runs on the first of every month at 3:30 AM ESDT | relkik@microstrategy.com

Send to a new address

Delivery Format:

PDF Compress contents

Subject:

Monthly Revenue Growth by Distribution Center Send a preview now

Click here to add a message

Apply OK Cancel

Month	Distribution Center	Revenue	Percent Growth
	New York	\$ 56,704	40.90%
	Milwaukee	\$ 82,044	37.79%
	San Diego	\$ 109,923	25.38%
Nov 01	Seattle	\$ 13,113	24.90%
	Boston	\$ 95,579	20.15%
	Miami	\$ 60,084	16.96%
	San Francisco	\$ 53,051	13.48%

Figure 37 – From any Web browser, MicroStrategy users can self-subscribe to receive and send any report based on time and event triggers.

7.4 Automatic Content Personalization

One of the biggest problems with any report distribution system is making large amounts of general information relevant to all recipients. Most people are only interested in a small slice of data contained with-

in a standard report. That slice might be one product, or one region, or one time period. But each recipient receives all data on all products, for all regions, and for all time periods because that's the way the report was generically designed.

MicroStrategy avoids the common pitfalls of generic reports by providing four levels of content personalization, ensuring that content is automatically personalized for each recipient.

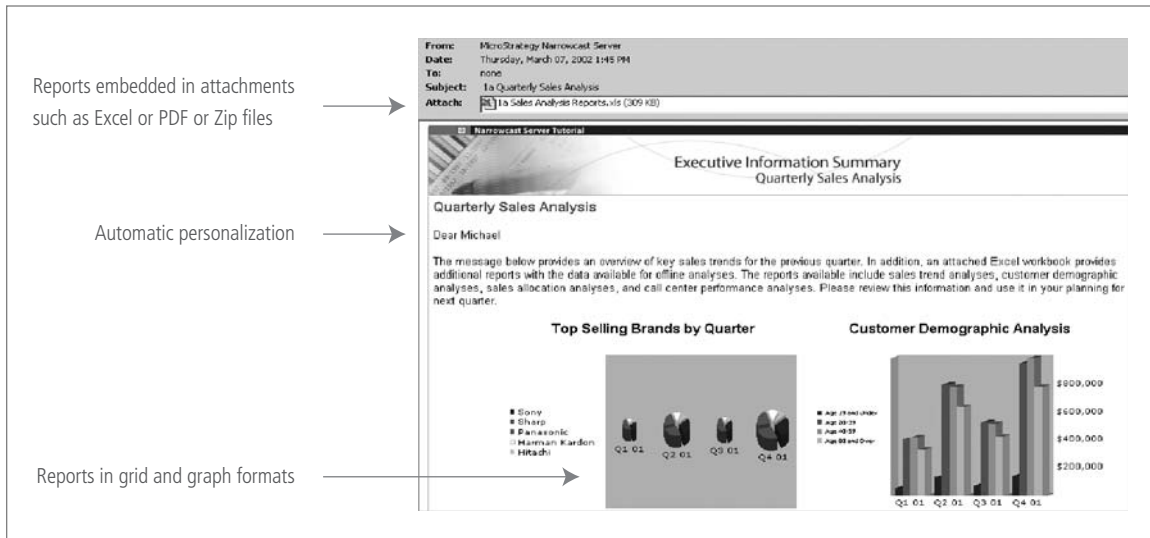


Figure 38 – MicroStrategy dynamically personalizes report content, so that reports emailed to any user are immediately relevant. MicroStrategy's emailed reports, such as the one shown above, can include HTML with multiple grids, graphs, rich text, pictures, links to Web-based reports, portals, or websites, as well as attachments such as Excel, PDF, and Zip files.

Four Levels Of Content Personalization

MicroStrategy uniquely delivers four levels of content personalization:

1. **Authentication personalization** associates relevant data with the user-stored profile. Users also can receive information from external sources, with user IDs and passwords integrated in external systems' security.
2. **Preferences personalization** lets users define the specific information they want to receive. For example, a user can ask to receive sales information for New York, Boston, or the northeast region. Users can choose to specify general preferences for all reports they receive or change preferences for specific subscriptions or reports.
3. **Locale personalization** allows users to specify how numbers and dates are formatted, which language should be used, and which international character set should be applied to their reports.
4. **Security personalization** allows the data in any report to be automatically tailored to include that data appropriate to each user's role and group affiliation. For example, security personalization can personalize the report content for regional managers to include just that data for each manager's region. Subordinates would see even less data, and superiors might see summarized data appropriate to their interests.

Personalization Minimizes IT Costs

IT administrators can choose to secure data for all reports by individual recipient or to limit an individual's data access to specific reports and objects. With MicroStrategy, profiles are dynamically applied to every report distribution. IT workloads and development time are greatly reduced because report designers can build one report that can be shared by all users, with the assurance that data will automatically be protected based on each user's different security settings (Fig. 39). For example, a report designer may create a report with sales data of all regions in the U.S.; this report will show only northeast data when sent to the northeast manager and only northwest data when sent to the northwest manager.

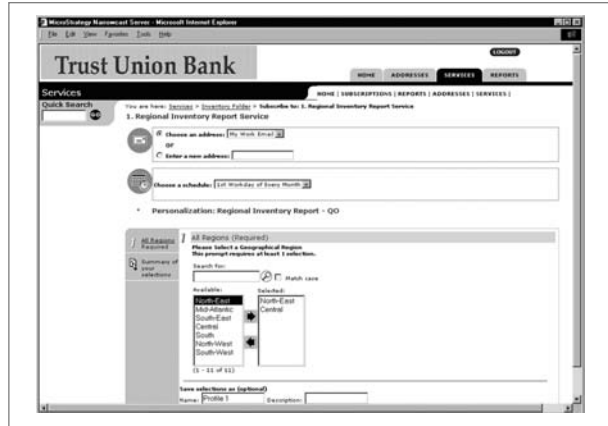


Figure 39 – MicroStrategy users can personalize further the content of any report by simply answering business questions using parameterized reporting.⁹

7.5 Report Delivery and Alerting Summary

Business intelligence should be pervasive throughout an enterprise. Companies need the ability to proactively push information into the hands of users wherever they might be, and through whatever interface is most appropriate to each person's usage. To meet this need, MicroStrategy's Report Delivery and Alerting style uniquely delivers several critical features:

- Delivered to any user touchpoint – Web, email, printers, file archives, and portals
- Distributions managed by a central administrator
- Distributions managed by end users themselves, based on subscription
- Reports delivered immediately (on demand)
- Reports delivered periodically (on schedule)
- Reports delivered based on a triggering event (on event)
- Reports that are personalized to each user automatically.

MicroStrategy technology accomplishes these extensive capabilities with the highest report throughputs available today, exceeding 70,000 reports per hour with minimal hardware.

⁹ Refer to Chapter 3 (Section 3.2) for more information on User-Defined Web Reporting.

8

UNIFIED USER INTERFACE AND UNIFIED BACKPLANE ARCHITECTURE

MicroStrategy is the only architecture that can deliver all 5 Styles of BI to all users through a **single unified user interface**. It is also the only architecture that can deliver all 5 Styles of BI on a **unified services-oriented backplane**.

Single Purpose Style of BI Tools Are Incompatible With Enterprise Strategies

Other vendors have distinct and separate software products that singularly provide a Style of BI. Those single purpose Style of BI tools suffer from isolated development and incompatible platforms, often resulting from acquisition of other companies. As a result, tools from one vendor all have distinctly different user interfaces, as well as a completely different infrastructure for metadata, security, performance management, and administration.

Is this important? Initially, it's not important; but it grows to great importance as BI begins to take hold within an organization. By now, most companies have over a dozen different BI technologies running within their enterprises. Each technology was originally purchased independently to support a single user constituency, with a single BI application, and focused on a single Style of BI. At the start, when there is only a single BI application, users are all working from the same page and talking the same language; and they only need to learn only one BI interface paradigm.

However, it never stays this clean. It is inevitable that these successful BI applications expand to more users – as people share the output of their BI application, more and more people want access to that same power. Furthermore, every successful enterprise is continually deploying more and more BI applications every day. Eventually, enterprises find themselves in the situation where they no longer have clean islands of isolated BI. Instead they have large and growing user populations that access multiple BI applications, and each of those users is dealing with a disorienting array of disparate BI interfaces on their desktops. They have BI applications with overlapping reporting domains, with each application producing similar but inconsistent calculations from the others. And they have a large amount of replicated data being moved into each of these BI applications over and over again.

Ultimately, the users are frustrated by:

- Complete lack of uniformity of their BI experiences
- Excessive time and effort incurred in training on so many tools
- Varying levels of help they get from IT for their different BI tools
- Inability to compare or combine the results of one report in one application with the results in another application.

IT is frustrated by:

- Continual complaints about inconsistent reports being generated by multiple tools caused by the disparate metadata
- Excessive costs and effort to maintain user profiles and adequate security levels consistent across all disparate BI technologies
- Excessive cost and effort to manage a multiplicity of vendors – maintenance update deployments, contracting, technical support
- Excessive effort to manage performance consistently across diverse technologies
- Excessive costs to maintain experts in each of the diverse technologies
- Excessive costs to move the replicated data into each of these disparate systems

The Business is frustrated by:

- All of the above
- Inability to deploy newer BI applications that span multiple Styles of BI

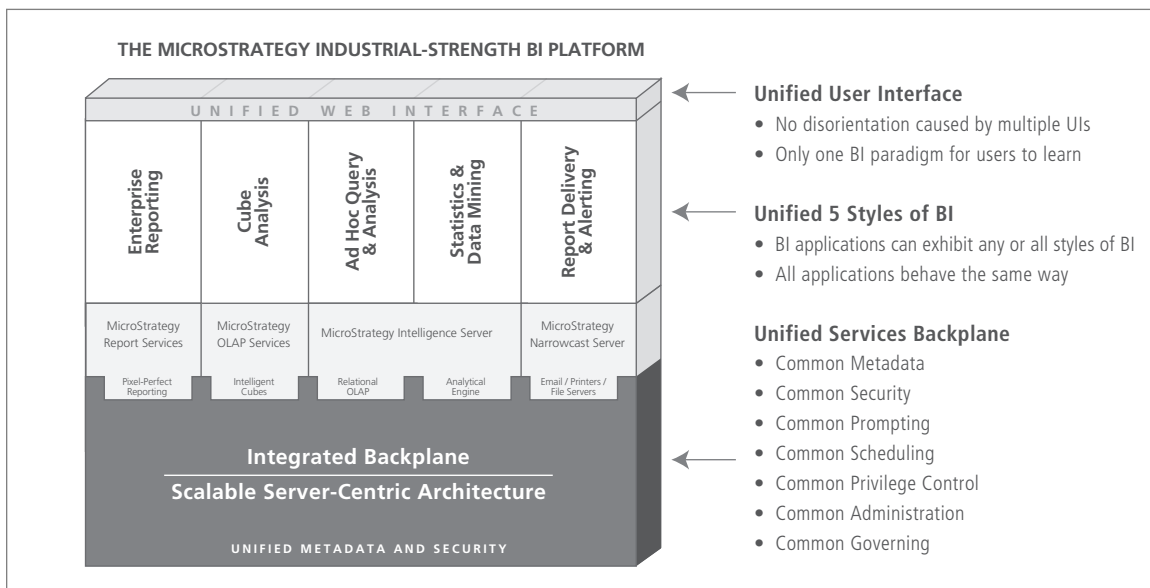


Figure 40 - Only the MicroStrategy architecture supports all 5 Styles of BI, on a single unified backplane, and presented through a single unified user interface.

Single BI Platform For All 5 Styles of BI Delivers Enterprise Success

The only solution to these problems is to deploy a BI architecture that offers a single unified user interface for all 5 Styles of BI – and a single unified services-oriented backplane for all 5 Styles of BI. MicroStrategy is the only architecture that does this (Fig. 40).

8.1 Single Unified User Interface

The user interfaces for BI are very rich nowadays. They present users far more than just buttons to run a report. Instead they embody an entire paradigm for interacting with enterprise data. At a minimum, a competent BI user interface establishes a paradigm for:

- Report Catalogs – Finding and organizing reports.
- Report Creation – Finding report components and laying them out.
- Report Execution – Running reports both synchronously and asynchronously, where requests are queued in sequence while the individual waits or processed in the background while the individual works on other things.
- Report Searching – Finding reports or objects to place on a report.
- Report Sharing – Sending reports to people on a periodic or one-time basis.
- Information Analysis – Conducting OLAP functions like page-by, pivot, sort, filter and drill.
- Report Exporting – Exporting the results to Excel, PDF, or flat files.
- Report Scheduling – Setting up reports to be pre-run, during off-hours so they are instantly ready for each user during the day.
- Report Printing – Full page layout and printer controls.

With all this functionality, it is easy to see how users are wholly disoriented when they are faced with multiple different BI interfaces. MicroStrategy is the only vendor that can offer complete uniformity of user experience across all BI applications.

Moreover, the MicroStrategy user experience goes beyond simple uniformity of interface across all 5 Styles of BI. It focuses equally on providing:

1. Complete BI Functionality Through a Zero Footprint Web Interface
2. Windows-on-the-Web Ease and Familiarity for All Users
3. Tailored User Interfaces to Accommodate Varying User Skills
4. Seamless Ability for Users to Move Between All Styles of BI

Full BI Functionality Through Ubiquitously Deployable Zero-footprint Web Interface

A single user interface must be able to deliver all BI functionality. The MicroStrategy Web interface provides users with full report viewing capabilities, full OLAP analysis capabilities, and full report creation capability. This is the complete range of BI usage. No other BI interface can match this range.

Moreover, the MicroStrategy Web interface accomplishes all of this functionality through a “zero footprint” on the web browser. That means the MicroStrategy Web interface avoids JAVA applets and ActiveX that present dangerous security holes to enterprises. It even avoids the dependency on browser cookies that are prevalent in all other BI interfaces and are becoming a privacy issue in many countries. All of this means that the MicroStrategy Web interface can be deployed to anyone, inside the corporate firewall or outside, without concern about security or concern about which Web browser is being used.

Windows-on-the-Web Interface Is Intuitive and Easy

Ease of use is paramount in deployments to large user populations. Actions need to be only one click away – and that one click needs to be in an intuitive place. No help desk can educate thousands of users on basic BI tasks. MicroStrategy’s Web interface was designed around the idea of providing a Windows-on-the-Web experience that would be immediately familiar to any user.

Windows-on-the-Web means using the full set of familiar Windows cues and techniques – through the zero footprint Web interface. That means that users get full use of drag-and-drop mechanics, drop down menus, context sensitive menus, mouse-over pop-up hints, and right-click options under every element on a report. All of these things are designed to allow users to easily find the function they need, in ways to which they are now accustomed from their Windows interface. At the same time, the MicroStrategy Web interface fully embraces the newer and widely understood Web-centric elements such as navigation bars, search boxes, and paging increments that can be found in popular Web sites such as Yahoo. If a user knows how to use Windows and knows how to surf Yahoo, they will know how to use MicroStrategy.

Tailored User Interface Accommodates Varying User Skill Levels

The MicroStrategy Web interface can be quickly configured to provide just the right set of functionality for each individual user. Application privileges, such as report creation, drilling, and subscription, can be set on a per-user or user-group level. This is done easily through role-based user profiles that are established on a centralized console for all users and groups. As users’ skill levels increase, the central administrator can add more functionality to individual and group profiles with the simple click of a checkbox on the central console.

Users’ Ability to Seamlessly Move Between All 5 Styles of BI

The MicroStrategy architecture has the ability to mix-and-match Styles of BI in any combination in any BI application. This means, for example, that a BI application could include scorecards, analysis cubes, and offer full ad hoc drilling anywhere in the database. Other vendors’ architectures are typically limited to a single Style of BI, or at most, two Styles of BI.

What this means to the end user is a seamless user experience for all their BI interests (Fig. 41). It means that users can start in business intelligence by simply consuming enterprise reports, such as a departmental or individual scorecards. As they gain confidence with the system, and want to explore the information more, they can click down to a full pre-defined analysis cube and easily analyze the results from many different pre-defined directions. It’s still a simple safe environment for novice users, but now with a distinct ability to sift through the information. As their needs become greater, users can click and seamless-

ly drill down to surf through the entire data warehouse, down to the transaction level of detail if necessary. Users can apply full statistical treatment to the results using the MicroStrategy Analytic Engine. And at any time, users can set themselves up to receive alerts for any reports, cubes, and scorecards on a periodic basis or if thresholds are being exceeded.

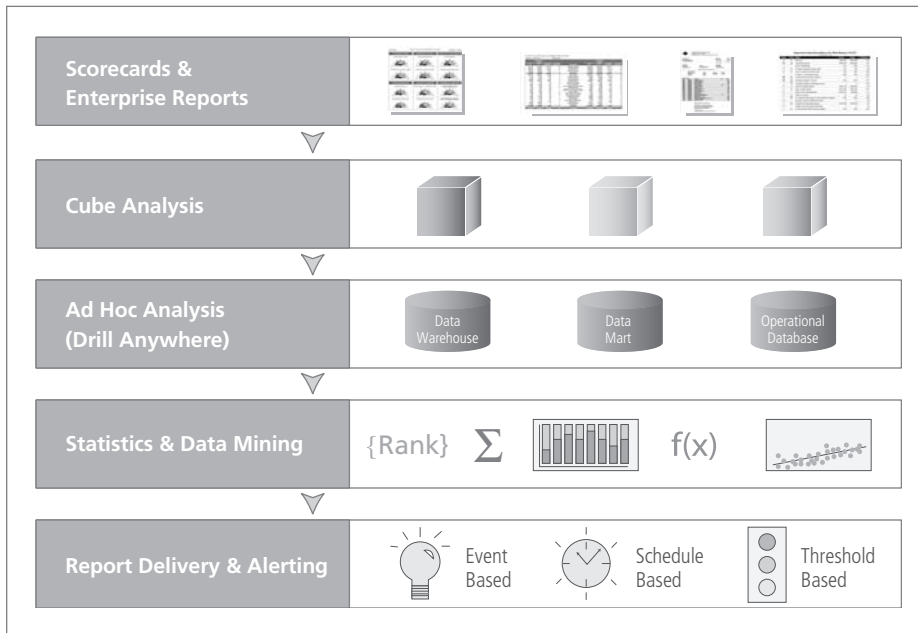


Figure 41 - With the MicroStrategy architecture, users can move seamlessly between all 5 Styles of BI as their needs dictate.

8.2 Single Unified Backplane

The MicroStrategy architecture supports all 5 Styles of BI on a single integrated and unified services-oriented backplane. This characteristic is unique to the MicroStrategy architecture. No other vendor's architecture can offer it.

The hallmarks of this unified backplane architecture are:

1. **Mix-and-Match Styles of BI** – So that each new Style of BI that is added to the system automatically adds functionality and value to all previously installed Styles of BI, and all previously built reports and applications.
2. **Integrated Services** – To achieve great efficiencies and consistency in report design, report maintenance, user administration, and security administration across all 5 Styles of BI through use of one unified metadata within the services-oriented architecture.
3. **Server-centric Architecture** – To achieve high scale and consistently high performance with great resource efficiencies.

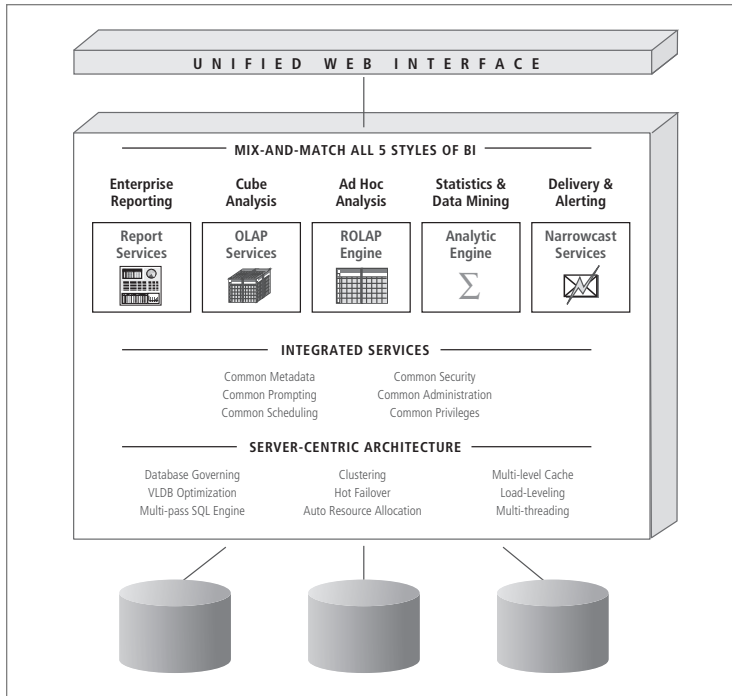


Figure 42 - MicroStrategy's unified services-oriented backplane allows complete mixing and matching of any and all Styles of BI.

The idea of a common backplane, offering services and integration for independent engines is not new. The term “backplane” originates in electronics, where backplanes are circuit boards that contain circuitry, sockets, and a communication bus into which additional electronic boards can be plugged to create a new fully synchronized product. In a BI system, the backplane serves as the common platform into which enterprises can plug new Styles of BI. It's this unified backplane that (1) allows users to move freely between Styles of BI, (2) ensures a single version of the truth with centralized metadata, and (3) supports very high performance with efficient management.

With MicroStrategy, the Styles of BI are designed as plug-and-play modules. This way, enterprises can deploy only the Styles of BI they need, when they need them; and those enterprises can expand with additional Styles of BI over time as the applications grow and users' skills are ready for it.

Mix and Match All Styles of BI

MicroStrategy's unified backplane design ensures that the new functionality embodied in each added Style of BI enhances the capabilities of all existing Styles of BI in use, adding functionality to all reports and applications that are currently being used. For example, when the Report Delivery and Alerting style is added to the backplane, users can immediately begin scheduling, subscribing, and emailing any existing report in the system. When the Cube Analysis style is added, any existing report can immediately behave like a full analysis cube with full cube functionality.

Enterprises can start with one Style of BI and then, as users need them, add new Styles of BI, at any time

in the life of the BI application. For example, enterprises can start with the Enterprise Reporting style and then add the Ad Hoc Query and Analysis style as users become more experienced and require more investigative capabilities. Conversely, other BI vendors' products are not integrated and do not share the same underlying backplane and metadata. As a result, when adding Styles of BI with other vendors, users and IT must recreate the user definitions, recreate the reports, and recreate the security restrictions because of the non-integrated nature of their product suites.

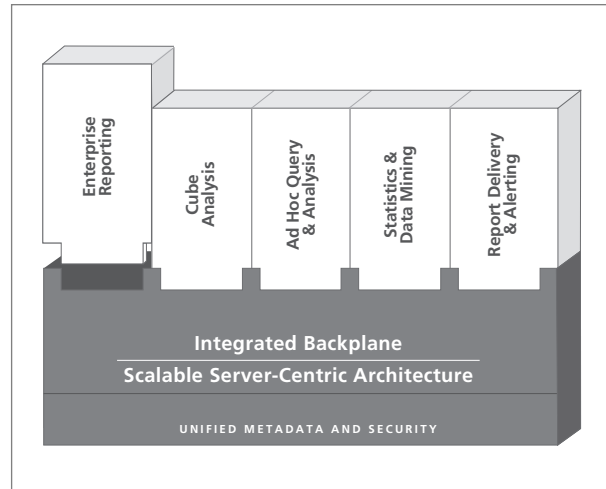


Figure 43 - The MicroStrategy architecture allows the Styles of BI to be mixed and matched so that companies can deploy just what functionality they need, when they need it.

MicroStrategy's SQL Generation Engine is able to resolve analytic queries entirely within the relational database engine and embedded OLAP engines in a collaborative fashion. MicroStrategy is the only BI software vendor that can deliver multi-pass SQL and SQL precisely tuned to an enterprise's particular relational database management system.

Integrated Services Create Great Efficiencies and Consistency Throughout the Enterprise

A layer of integrated services ensures that all Styles of BI are using the same metadata, same scheduling, same administration, same security, and same user definitions. This re-use and consistency, in turn, ensures that an enterprise BI system portrays only a single version of the truth, delivers new BI applications most rapidly, and minimizes the amount of maintenance effort by IT.

Integrated Services Ensures a Single Version of the Truth

Metadata represents the building blocks of any BI system and includes all business metrics, attributes, filters, templates, reports, prompts, user profiles, security levels, and distribution services. They are the items that a report designer drags-and-drops onto a report to define the report contents and layout.

MicroStrategy's completely centralized and object-oriented metadata ensures that one single version of the truth propagates throughout the enterprise – no matter which report or which BI application. With MicroStrategy, only one definition exists for every business metric and attribute, and all Styles of BI re-use those unique definitions. With other vendors' architectures, where there is a separate metadata for each Style of BI, every BI application typically has different definitions for everything.

Integrated Services Minimizes IT's Maintenance Effort Dramatically

A study by a leading IT industry firm shows that maintenance activities constitute more than two thirds of the full IT lifecycle costs, with almost one third for hardware and software costs, and an almost insignificant amount for the initial development costs. In fact, initial successes with a new BI application are often followed by disappointment with the total cost of maintenance and enhancement. As applications begin

to grow to hundreds or thousands of users, and incorporate ever-greater numbers of reports, the difficulty of maintaining these proliferating applications becomes complex, overwhelming and expensive. This is typical of single purpose Style of BI tool kits with multiple metadata for each different Style of BI. In time, the multiple applications with multiple metadata can act like a barrier to further innovation out of fear of disrupting what is in place.

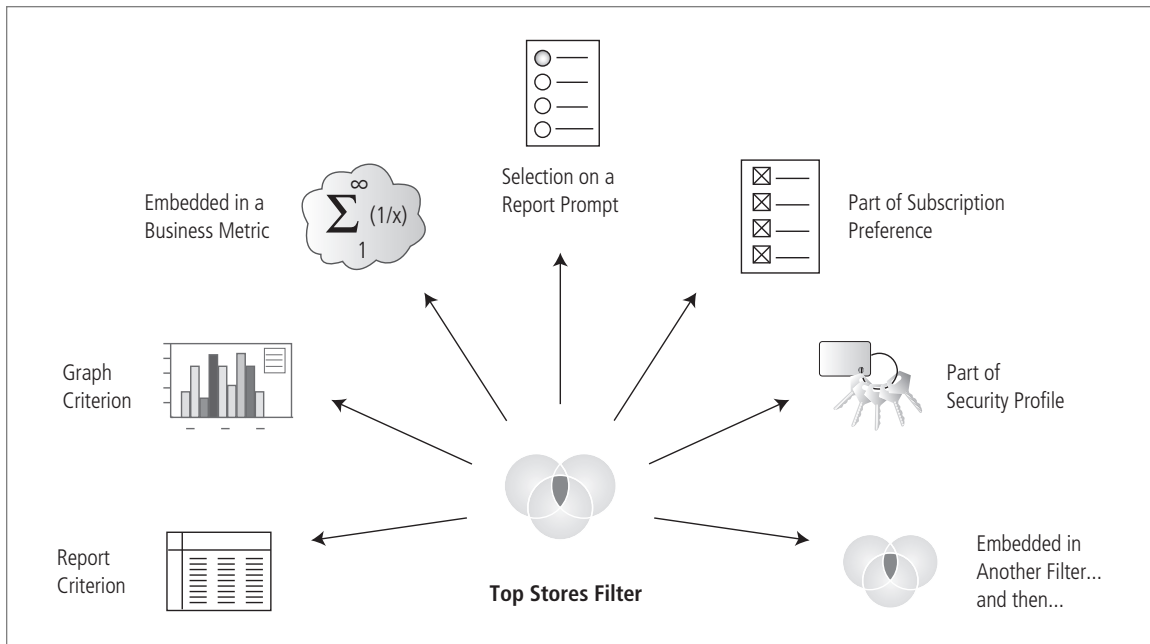


Figure 44 - MicroStrategy's metadata is fully object oriented allowing complex objects to be made of smaller simpler objects in an arbitrarily flexible way. If any object definition changes, then all objects dependent on the changed object will also be changed automatically.

MicroStrategy's metadata is fully object oriented so that every object inherits the characteristics of the object embedded into it. This allows MicroStrategy users to build otherwise complex objects by using smaller simpler objects. If any object definition changes, then every object dependent on that simpler object will automatically change as well. For example, if the definition of the profit metric includes a filter object, which in turn includes a sales metric object, then any change to the sales metric object will automatically ripple through the filter object and the profit metric. This is a huge benefit to IT organizations who are tasked with maintaining the internal consistency and integrity of so many business definitions.

For example, the Top Stores Filter (Fig. 44) includes the set of all stores whose sales exceed average store sales by two standard deviations. This filter can be used with any other object within the MicroStrategy platform, such as within a report, within a business metric definition, within another filter, and within a user prompt. This greatly minimizes the workload of administrators since they only create an object once and can use it as many times as needed with other metadata objects.

Integrated Services Speeds Application Development Times

The ability to re-use any object or service within the integrated services architecture ensures that each new

application requires less time and less effort to assemble than the previous ones. Each new application can re-use the attribute definitions, user profiles, filters, prompts, metrics, and security from all prior applications to speed along the development. The more applications a company has with MicroStrategy, the faster each new application is to develop.

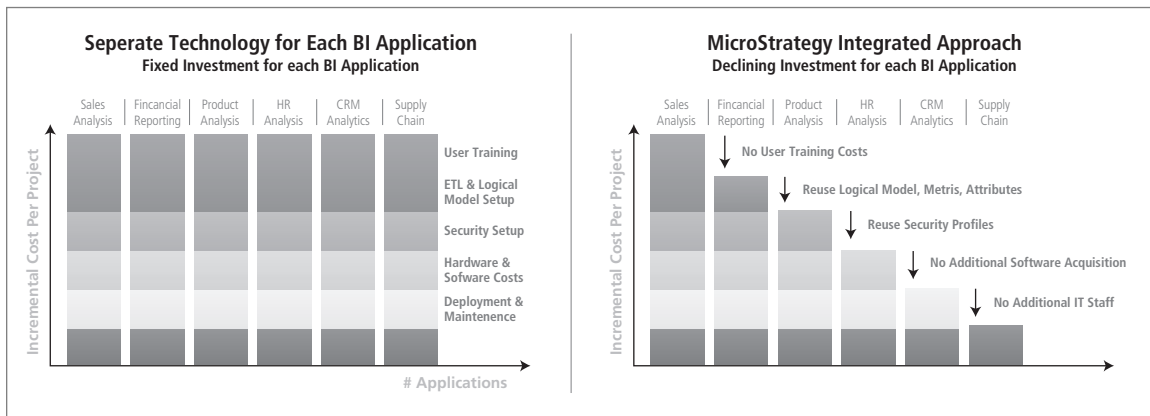


Figure 45 - Each new BI application takes less time, less effort, and less cost with MicroStrategy because of MicroStrategy's ability to reuse all previously-built components, such as metrics and security profiles.

Server-centric Architecture – Achieves the High Scale with Consistently High Performance and Great Resource Efficiencies

As enterprise BI applications become more popular and successful, the number of users can easily increase to thousands, with large numbers of reports and data volumes. As a result, single purpose Style of BI tool kits, which were designed for small number of users, typically face rapidly deteriorating performance. In addition, the stability of the system is greatly affected, and hence the availability of the overall BI system.

The MicroStrategy architecture is server-centric – it is designed to solve these performance and availability problems and support all 5 Styles of BI. By providing rock-solid services across all Styles of BI, MicroStrategy has been able to perfect the operational characteristics of an enterprise-caliber BI system with capabilities like native clustering, multi-level caching, load balancing, performance governing and prioritization, optimized SQL generation, and fail-over capabilities.

All of these add up to a superior ability to support consistently high performance of mission-critical 24 x 7 operation at any scale.

Server-centric Backplane Delivers Superior Load Balancing For Increased Performance and Stability

An important benefit of built-in clustering in the MicroStrategy architecture is the ability to spread the load of all users across the available hardware servers. Rather than purchasing dedicated hardware infrastructure for each of the Styles of BI, a unified BI backplane allows the efficient use of hardware investments.

MicroStrategy's load balancing ensures that user sessions are automatically distributed across multiple

servers, allowing the processing to be carried out by multiple servers simultaneously (Fig. 46). In addition, clustering allows enterprises to preserve their investment by starting with a small server implementation and adding hardware incrementally as the number of users increases. As a result, the initial investment in hardware is always preserved and performance is always optimum.

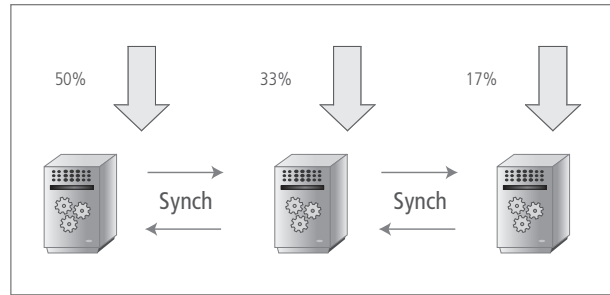


Figure 46 – The workload is automatically distributed across clusters based on the hardware processing power.

Server Centric Backplane Delivers Automatic Fail-over for 24x7 Operations

Providing high availability and maximum reliability is a crucial requirement when implementing enterprise-class BI systems for day-to-day business decision-making (Fig. 47). The failover system must work the same for all Styles of BI to ensure 24x7 operations for all BI applications.

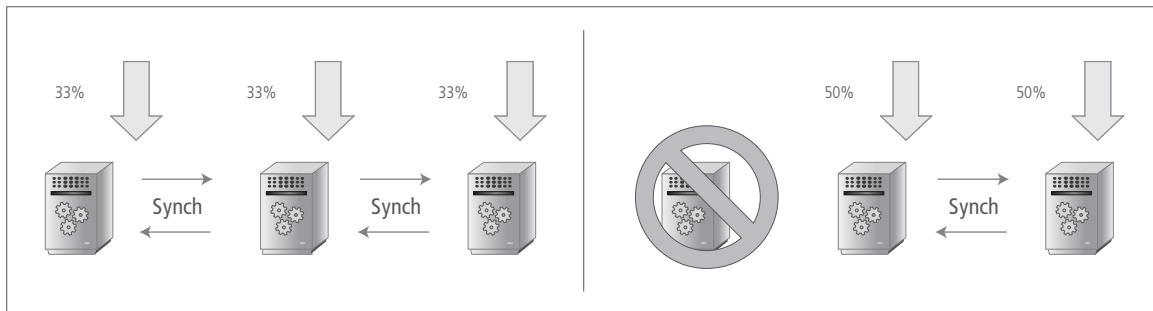


Figure 47 – Workload is automatically transferred from a failed cluster node to another to ensure 24x7 operations.

MicroStrategy has a history of supporting enterprise requirements, and was the first to deliver a high availability, fault-tolerant BI architecture. Armed with an infrastructure that provides support for hot standby, automatic fail-over, and clustering, MicroStrategy customers enjoy uninterrupted BI operations. In the event of a hardware or software failure, users are automatically routed to available hardware or software in the cluster. These capabilities are integrated in the server-centric MicroStrategy architecture and available out of the box.

Server-centric Backplane Supports Shared Caching Across All BI Styles For Fastest Performance

As the number of queries processed by the system grows over time, the likelihood that the same slice of information is requested more than once increases rapidly. A very effective way to increase the query performance, while reducing overall system usage, is to use caches. A cache is merely a piece of data that, in order to be quickly retrieved, is stored in a more readily used format than its source.

MicroStrategy caching let users perform speed-of-thought analysis since the report data is automatically retrieved from the central cache, without the need to access the database. Furthermore, all cached data is

automatically synched with the database. Caches can be refreshed based on time-schedules, alert triggers, such as a data warehouse load, or manually. Additionally, MicroStrategy uses a smart 4-level caching architecture shared across all BI styles: caching of reports, caching of business attribute elements, XML caching, and BI objects caching. This caching architecture has the counter-intuitive effect of improving performance with more users that access the system. No other BI tool in the industry currently provides this advanced capability. Since caches can be shared between all the clustered servers, any request for data from any server can be matched against available caches in the cluster, making performance even faster.

Server Centric Backplane Delivers Streamlined Centralized Administration

With MicroStrategy, companies can manage all of their BI applications, regardless of style, from a single centralized console. MicroStrategy administrators can monitor and analyze the real-time use and performance of the BI system, tune the system appropriately, deploy new projects rapidly and easily manage large BI implementations with scripts, all from a central location.

MicroStrategy lets administrators determine how the application is being used, application performance and report usage. MicroStrategy provides real-time information that displays statistics about key activities and usage data for all applications. Leveraging these statistics with rich historical views of the system, administrators can quickly distinguish temporary anomalies in usage and performance, that are of minimal importance from trends that may have a wider impact on the system. These statistics include information on all BI objects, number of users logged to the system, their detailed actions, current executing queries, scheduled reports, caches, queries with errors, database connections and more. For example, with this information administrators can understand which reports are most frequently run, what caches are most frequently hit, and execution times of reports. Administrators can then determine which reports need to be cached or where Intelligent Cubes can most effectively be used. Running a real enterprise-caliber BI system is more complex than populating and distributing cubes as with departmental-caliber tools; it requires the same kind of coordination from an administrator's console as other enterprise applications.

Conclusion

The MicroStrategy architecture is unique in the BI industry.

- It is the only architecture that supports all 5 Styles of BI in a **mix and match** fashion, allowing customers to implement just the functionality they need, whenever they need it.
- It is the only architecture that delivers all 5 Styles of BI through a **unified user interface** that is simple enough for novice users, and powerful enough for the most advanced users.
- It is the only architecture that delivers all 5 Styles of BI on a **single unified backplane** that ensures rapid development time, minimum maintenance effort, a single version of the truth throughout the enterprise, and 24 x 7 operation.

Ultimately, the MicroStrategy architecture is future-proof. Companies can start small with limited functionality and limited scale, but can grow to include all BI functionality, with the highest scalability, highest performance and best reliability.

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