



AN ARCHITECTURE FOR SOFTWARE-AS-A-SERVICE (SAAS) BUSINESS INTELLIGENCE

A REVIEW OF THE MICROSTRATEGY PLATFORM ARCHITECTURE FOR
HOSTED REPORTING, ANALYSIS AND MONITORING APPLICATIONS

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I. EXECUTIVE SUMMARY

The current demands of today's economic environment require enterprises of all types to efficiently leverage their increasing data assets in order to make informed decisions to support their business processes. For this reason, companies are challenged with escalating demands for more business intelligence (BI) across all levels of their enterprise. At the same time, companies are increasingly becoming more familiar with the concept of Software-as-a-Service (SaaS) as a way to have technology available on-demand, reducing their burden in terms of deployment, configuration, maintenance, and other inherent project risk factors. These two trends combined translate into a need for immediate return on investment on projects that enable them to collect and analyze corporate information to get an accurate view of their business across the entire organization.

Simply defined, SaaS is software deployed by a hosted provider that can be accessed over the Internet. The main characteristics of a SaaS application include:

- **Multi-tenancy support** – enabling a single instance of software to serve multiple client organizations, or tenants.
- **Fast development and ease of maintenance** – minimizing deployment and maintenance work, for both the SaaS provider as well as for its clients.
- **Centralized administration** – providing large amounts of data to more users while using administrative resources efficiently.
- **Comprehensive security** – sharing the resources available across multiple users or tenants while still being able to differentiate data and functionality available to each individual customer.
- **High scalability and performance** – providing a reliable 24x7 operation under high user concurrency and vast amounts of data.
- **Ease-of-use** – maximizing end user self-service through advanced functionality delivered in an easy-to-use interface.
- **Flexible and personalized interface** – modifying and extending the user interface to satisfy individual needs, including application look-and-feel, sophisticated functionality, and engaging ways of displaying relevant information to users.

Over the past twenty years, most organizations have required all major technologies to be installed in-house, often due to requirements of security, availability, and convenience. Specific to BI, many of these same organizations acquired a diverse collection of products because each of these different technologies offered a particular strength in a single area. Many of the more sophisticated products were built using client-server architectures or leveraging client technologies such as Java or ActiveX, and have proven to not be pervasive or easily-deployed in an on-demand SaaS model.

With the advent of more sophisticated, demanding end users, pervasive Internet connectivity, improvements in the scalability and security of middleware and back-end technologies, and defined open standards, we are in the midst of a major transformation in the BI industry towards an on-demand model. Whether an organization that has built an enterprise data warehouse is opening up that data to third party partners and customers or a data syndicator is building a shared data warehouse to deliver value to multiple customers, a sophisticated BI platform is required to deliver the demands of these SaaS applications.

This whitepaper discusses the capabilities within the MicroStrategy platform that make it the mature, organically-

grown technology best-suited to meet and deliver these demands.

II. INTRODUCTION

Business intelligence is often associated with companies that need to analyze their internal information in order to monitor and improve their business processes. Data must be provided in an easy-to-digest format to report performance to the corporation, and to business partners, customers, and the general public. Over the past few years, several MicroStrategy partners and service providers have begun offering BI within a hosted environment through MicroStrategy's BI platform. A hosted solution offers end users the opportunity to improve their decision-making capabilities even when they lack the business and technical resources to support their own internal data warehouse.

For instance, the Ohio Department of Education designed such a system using MicroStrategy to provide easy access to primary and secondary public school performance directly from their website. The application lets anyone with an interest in the state's education program – parents, teachers, administrators, legislators or journalists – get easy access to the latest performance and statistical data pertaining to any school district or individual school in the state. In this way, MicroStrategy's flexible technology provides broad access to school performance report cards electronically, helping parents and others make decisions about education whenever they need it.

BI technology has evolved from these ever-increasing user and architectural demands to support five distinct application patterns or styles. These five styles represent the complete spectrum of BI functionality required to support the monitoring, reporting, and analytical needs of each and every business user:

- **Scorecards and Dashboards** – highly graphical reports designed to monitor corporate performance
- **Reporting** – print-perfect operational and business reports with interactive content
- **OLAP Analysis** – slice-and-dice analysis with drilling, pivoting, and other investigative features
- **Advanced Analysis** – set analysis, statistical and trend analysis, and data mining
- **Alerts and Proactive Notification** – continuous scanning of data for exceptions and alerts

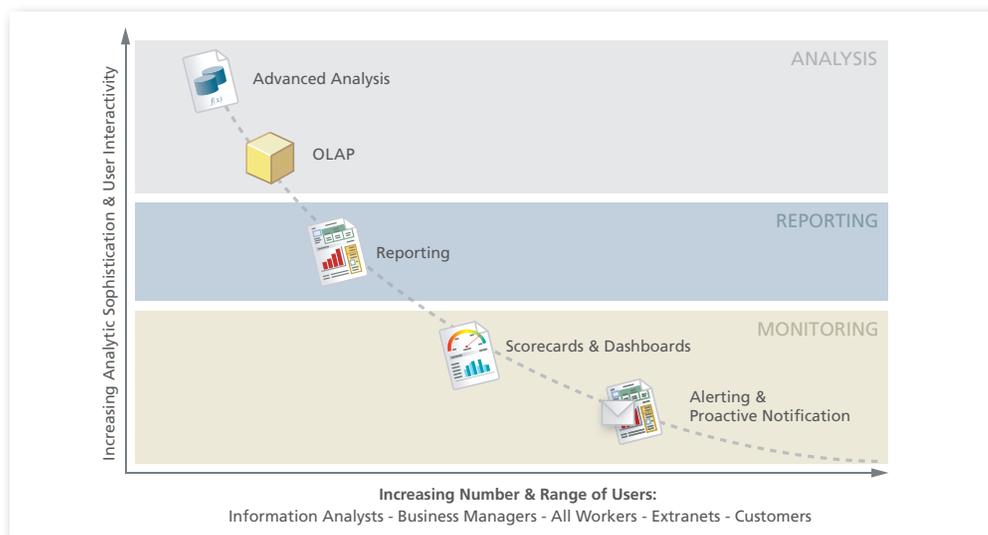


Figure 1. Over the preceding decade, BI vendors have produced different technologies to support the 5 styles of BI applications. Only MicroStrategy delivers all 5 Styles of BI within a single, unified architecture.

The MicroStrategy platform was designed specifically to usher in a new era in business intelligence, with an architecture that is organically integrated and designed for SaaS Business Intelligence. Thanks to its zero-footprint, browser-based interface, users with diverse backgrounds, experience levels, and roles can easily access all of these applications, navigating seamlessly between different application areas. For example, users can view a scorecard formatted for viewing and printing, drill from the scorecard to perform more detailed analytical analysis, incorporate advanced statistical functions, and share the results with other users through e-mail. All of these steps are achieved without the users having to switch interfaces or applications, allowing them to maintain context and see the same data across different BI styles.

In addition to supporting these various BI styles, a SaaS BI platform has additional requirements, including a sophisticated platform architecture, centralized development and administration, security, scalability, ease-of-use and personalization capabilities, which are described in more detail below.

III. EFFICIENT PLATFORM ARCHITECTURE TO SUPPORT HOSTED DEPLOYMENT

SaaS enables companies to quickly deploy functionality in a fraction of the time it would have taken them to procure specialized software, hire and train internal staff, gear up installation planning, and deploy the necessary functionality¹. SaaS vendors, on the other hand, need to focus on delivering a solution in a cost-effective manner so the business model is proficiently implemented and managed.

MicroStrategy's breakthrough technology supports both of these competing requirements through one organically-grown platform thanks to its integrated architecture, powerful reporting, and unified interface. MicroStrategy's unique strength at the high-end of BI extends the boundaries of performance, scalability, and efficiency of enterprise BI while also supporting the most demanding requirements of SaaS BI initiatives: distributing vital data across all levels of SaaS client organizations securely and efficiently, and providing a single version of the truth about each client's business.

Integrated Backplane Yields Dramatically Lower Administrative Overhead

With competitive BI architectures, organizations often find that, as the demand for applications increases within the enterprise, associated administrative and management costs escalate dramatically. Fragmented architectures also result in multiple development teams, little or no re-use between applications, disparate security models, more user groups to maintain, and additional administrators to deploy and support the applications. MicroStrategy's unified, flexible architecture provides the lowest total cost of ownership as it allows SaaS providers to create BI applications with a single security model, advanced parameterized reports, and a common metadata repository across all styles, resulting in rapid deployments and reduced administrative and development overhead.

MicroStrategy's integrated backplane architecture provides the common services of metadata, prompt generation, scheduling, shared caching, security, user management, query generation, query governing, and administration. More importantly, it is the core engine which supports each of the 5 Styles of BI as plug-n-play service modules that can incrementally add functionality when mixed and matched in any combination. These modules include MicroStrategy Report Services for Pixel Perfect™ reporting, dashboards, and scorecards, MicroStrategy OLAP

¹ TDWI. Frankel, David. "Hosted Business Intelligence – Why the Time is Right". November 5, 2008. <http://www.tdwi.org/News/display.aspx?ID=9209>

Services for speed-of-thought slicing and dicing, and MicroStrategy Distribution Services for alerting and proactive notification functionality.

For example, a SaaS provider can add the OLAP Services module to the engine, and all previously-built grid reports available to the users automatically become Intelligent Cube™ reports, and inherit a wide range of new functionality. In a later development stage, the provider can add the Report Services module, and the customers will be able to re-use all the previously-built grid and cube reports as datasets for a new Pixel Perfect interactive dashboard. And finally, the hosted application can add the Distribution Services module so users can immediately begin accessing grid reports, Intelligent Cube reports, and dashboards as the basis for e-mail alerts and proactive notifications.

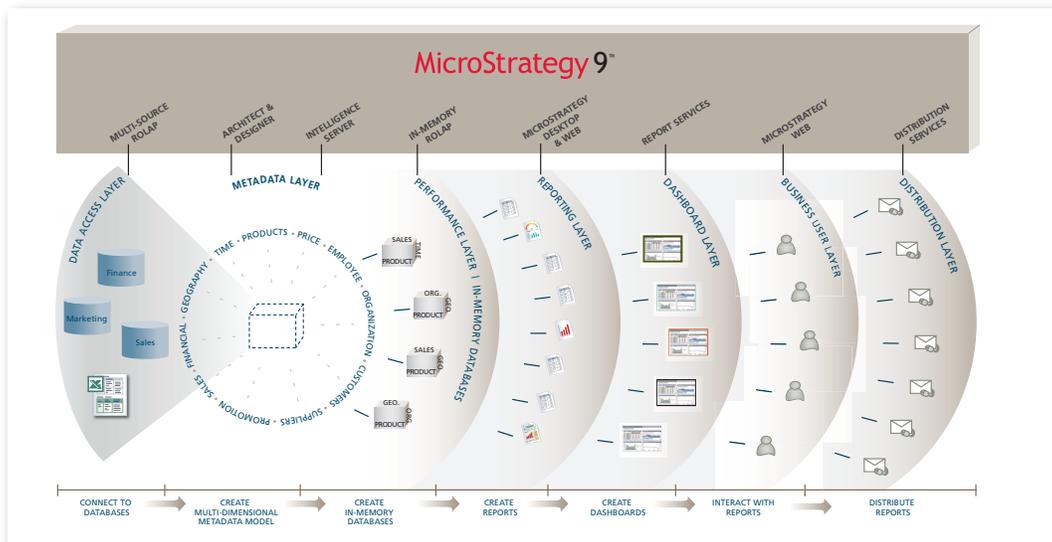


Figure 2. With MicroStrategy, SaaS providers have all the technology they need to develop a comprehensive BI system. MicroStrategy's breakthrough technology supports each of the 5 Styles of BI as modules that can be incrementally combined.

MicroStrategy's flexible and component-based architecture enables rapid deployment of SaaS BI applications with the lowest total cost of ownership. These applications can seamlessly add new functionality and services as the needs of the end users evolve. Unlike other BI architectures, MicroStrategy users constantly access and analyze the data from a single, intuitive interface that presents one version of the truth. Users are therefore not forced to deal with multiple interfaces and unlinked metadata repositories housing a wide variety of reports, analyses, and business definitions. Such an environment often translates into reduced software adoption, increased training costs, or lost productivity.

A Hybrid Data Access Architecture for Powerful Reporting

SaaS BI applications must handle terabytes, or even petabytes in the near future, of data across distinct companies. In order to be able to distribute this vast amount of data efficiently to hundreds of users, a scalable, high-performance architecture is required for providing reporting and analysis without hindering performance.

MicroStrategy's Relational On-Line Analytical Processing (ROLAP) architecture is unique among BI products in that it can model the entire relational database as if it were a single multi-dimensional cube. In this case, the cube is virtual since relational databases often contain terabytes of data that could not fit within any real cube technology. MicroStrategy's virtual cube provides MicroStrategy users with the ability to perform OLAP interactions with the

data, including pivoting, page-by, filtering, and most importantly, the ability to drill freely throughout the entire database, but without the severe size limitations of Multi-dimensional On-Line Analytical Processing (MOLAP) architectures.

Another key requirement for SaaS BI is the ability to flexibly access many databases at once. MicroStrategy addresses this need directly with an innovative multi-source capability that links together new databases to the BI model without consolidating all data into a data mart or data warehouse. This allows developers to model each instance of data only once within MicroStrategy's metadata model, even if that data spans multiple database sources such as data warehouses, data marts, operational databases, departmental databases, Microsoft Excel® spreadsheets, and even text files. Designers can then create reports and dashboards without any knowledge of where the data is sourced. In fact, one query might create individual passes of SQL that source data from multiple different database technologies.

Finally, for subsets of data across different data sources that are frequently accessed, MicroStrategy enables users and administrators to define and schedule the creation of In-Memory Cubes. If any report is run that can be resolved by these cubes, MicroStrategy's engine immediately re-routes the query to the in-memory cubes, providing the performance of a MOLAP architecture. If a user ever needs additional detail or drills beyond the subset of data in the cube, MicroStrategy reverts to its ROLAP multi-source engine to resolve the query. In this way, MicroStrategy delivers a hybrid data access architecture that has the rapid performance characteristics of a MOLAP technology, with all of the flexibility and scalability of a ROLAP architecture.

Single, Centralized Server Provides Scalability, Security, and Robustness

MicroStrategy Intelligence Server is the industry's most advanced, scalable, secure, and robust business intelligence server, efficiently scaling from a few users to millions of users, delivering high-performance querying, reporting, and analysis. With a completely open architecture, the server is built on industry standards to seamlessly integrate into any existing IT framework, including Windows®, high-end UNIX®, and Linux® servers. The MicroStrategy Intelligence Server is the architectural foundation of the MicroStrategy platform, with MicroStrategy Web being the major node from where users access information, and from where information is distributed to users, as illustrated by the diagram below.

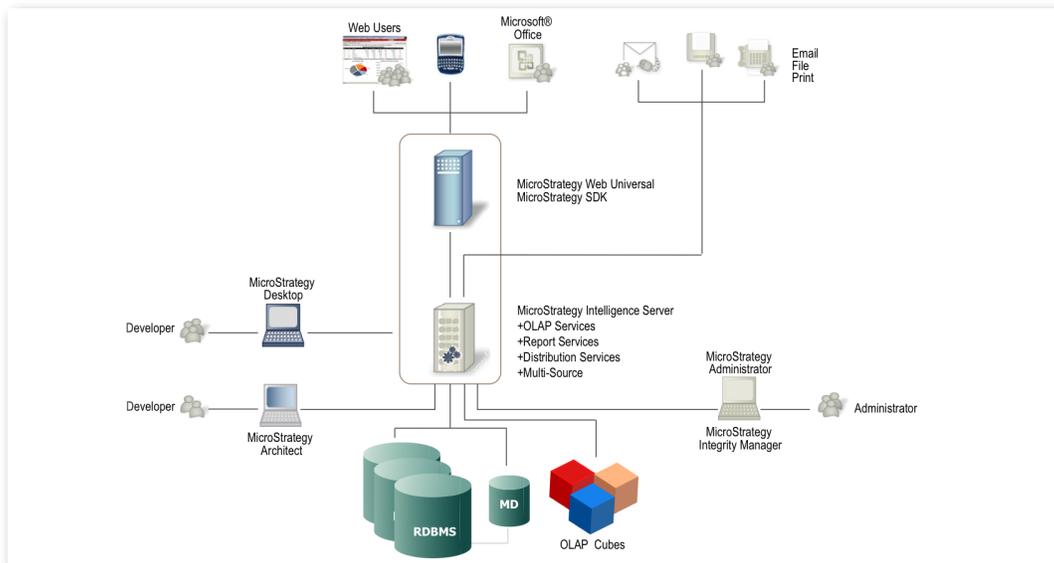


Figure 3. MicroStrategy's platform architecture allows for a centralized server or cluster to handle all user requests regardless of end user interface, including Web, e-mail, Microsoft Office, mobile devices, etc.

MicroStrategy's centralized server provides the core analytical processing and job management for all reporting, analysis, and monitoring applications regardless of end user interface. It simultaneously enables ease of deployment to all customers, a critical deployment paradigm required for SaaS architectures. In addition, the server can be clustered to provide 100% up time, complete fault tolerance, and failover, which helps maximize the availability of SaaS analytic applications. Furthermore, MicroStrategy Intelligence Server automatically tunes itself as the usage profile changes to ensure the highest level of performance at all times. These next-generation characteristics, including caching, security, and clustering features allow all users, internal and external to the enterprise, to access an analytic application securely without a loss in performance.

The MicroStrategy Intelligence Server's single code-based architecture, compiled to both 32-bit and 64-bit operating systems, ensures that the latest functionality is always available across these systems. SaaS providers can combine MicroStrategy's industry-leading scalability with the advantages of 64-bit operating systems to deploy the richest SaaS BI applications, with the highest performance, the largest data volumes, and the most users — all on the fewest servers.

An Integrated Web Interface Provides Intuitive BI to All Users

MicroStrategy's unified Web interface is a single code base that provides BI functionality to all users, ranging from basic reporting functionality for novice users, to interactive analysis functionality for analysts, to full report design functionality for power users and IT professionals. With a platform independent Java architecture at its core, MicroStrategy Web provides SaaS organizations a choice of a thin layer of Java Server Pages (JSPs) or Active Server Pages (ASPs). End users receive the exact same functionality and experience regardless of the provider's choice of application server, hardware, or ASP/JSP front-end.

MicroStrategy Web presents the same screen layout, the same drag-n-drop actions, the same menus, and the same toolbars regardless of user skill level and regardless of which style of BI a person is using. By contrast, competing "integrated Web interfaces" from other vendors are hardly unified at all. They present different screen layouts, different drag-n-drop actions, and different drop-down menus for each of their various "integrated interfaces" because many of those interfaces were acquired or were developed independently of one another over an extended period of time.

Furthermore, because of the way it is designed, the MicroStrategy Web interface can deliver BI functionality equally well to multiple different interfaces, including different Web browsers, third-party enterprise portals, and even to the Microsoft® Office applications of Excel, Word, PowerPoint®, and Outlook® using Web services.

These architectural strengths of the MicroStrategy platform allow it to meet the needs of thousands of SaaS users, each with unique data, functionality, and interface requirements. Adhering to our basic philosophy of organic technology development often entails making difficult technical choices where the tradeoff is between expediency (purchasing a technology quickly just to satisfy the immediate market requirement) versus long-term flexibility (designing something with primary emphasis on extensibility and maintainability over time). However, the benefits of these architectural decisions have resulted in an enterprise architecture designed to scale to the more advanced requirements of SaaS.



Figure 4. One design automatically displays well on all interfaces, minimizing IT deployment efforts.

IV. UNIFIED METADATA TO MINIMIZE DEVELOPMENT AND MAINTENANCE EFFORTS

Metadata is information that describes another set of data. In a business intelligence platform, metadata links information in a data store to business entities, and defines rules that construct a BI application. At the lowest level, metadata translates table and column information from a data warehouse into meaningful business terms. It unlocks valuable information stored within data warehouses by serving as an intuitive map to guide business users in building reports and conducting analyses using terminology familiar to them.

Today's BI platforms need centralized, reusable, dynamic metadata to support SaaS BI applications where a cohesive model of a business is represented. SaaS providers often find themselves modifying their applications to suit specific customer requirements. In fact, the effort and staffing required to maintain different customer requirements within the same environment (multi-tenancy) while also guaranteeing consistent definitions across common terms is often the hardest part of supporting a SaaS application.

The MicroStrategy object model is the genius of the MicroStrategy platform, giving every user the building blocks to assemble reports and dashboards or to conduct investigative analyses using a business viewpoint. MicroStrategy's integrated metadata stores these objects in a database for efficient re-use, manageability, and performance, leveraging security to allow specific customer customizations while minimizing the effort required to manage these changes. Ultimately, this integrated metadata enables SaaS providers to modify their data architecture and quickly add new reporting components to their solution, without significant re-development effort. Because the BI metadata presents a single cohesive model, all users can be assured that a single version of the truth will exist throughout all reports, dashboards, and analyses, and across all interfaces including a Windows developer interface, Web browser, e-mail client or Microsoft Office, regardless of who creates them.

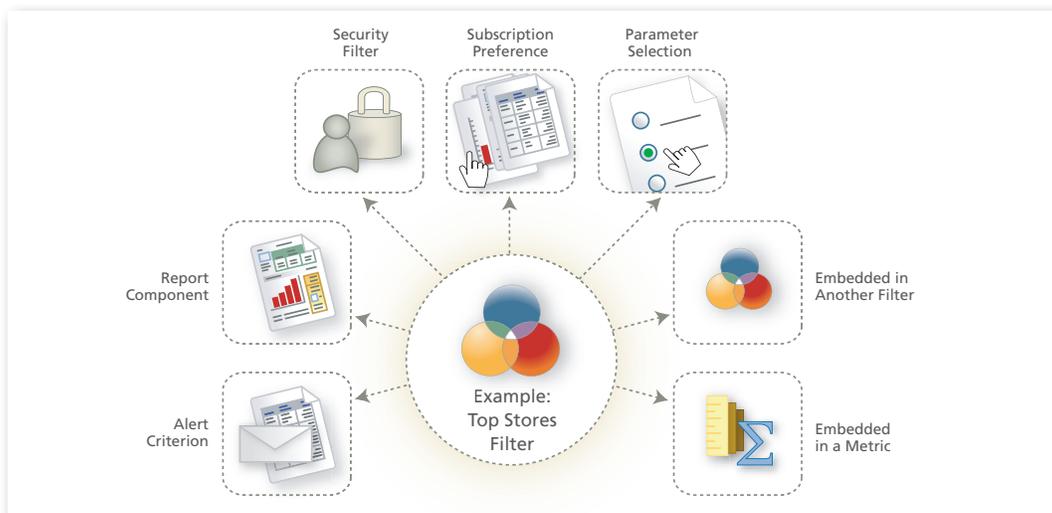


Figure 5. MicroStrategy's reusable object-oriented metadata maximizes object reusability while minimizing maintenance and development efforts. This diagram shows an example of how a filter object can be re-used in many scenarios throughout the application.

The dynamic nature of MicroStrategy's metadata ensures that reports are immediately up-to-date whenever an underlying object changes. This automatic and instantaneous updating applies even when objects are used within other objects. Unlike other BI technologies, a MicroStrategy report contains references to other dynamic metadata objects such as filters and metrics, rather than hard-coded definitions of these components. As a result, when a change is made to a lower-level object, all reports and other dependent objects immediately assume the change without any re-development effort.

MicroStrategy's reusable object-oriented metadata combined with MicroStrategy's security model (described later in this document) promote the ability to host multiple tenants in one environment. MicroStrategy allows each distinct tenant to use any of the 5 Styles of BI leveraging the same definition of a report or dashboard, while empowering administrators and selected power users with the ability to manage these central definitions. This dynamic metadata architecture allows SaaS providers to deploy a solution with minimal upfront investment and even less ongoing maintenance effort, delivering more BI to more users with less IT personnel.

V. CENTRALIZED ADMINISTRATION TO DRAMATICALLY REDUCE IT COSTS AND EFFORT

Administration and maintenance activities consume extensive IT resources using traditional BI tools. Centralization and automation can reduce administrative efforts. A BI architecture with duplicative or redundant metadata, user interfaces, administration consoles, and servers – software inefficiencies – is difficult to manage and more costly to maintain. MicroStrategy's single object repository and single server provide maximum administrator efficiency. Consolidation reduces costs, and as the data shows, allows a single MicroStrategy administrator to serve hundreds of end users. Dynamic data sourcing, database optimization, and instantly propagating MicroStrategy object updates reduce maintenance overhead. MicroStrategy's BI platform provides efficient administration and requires little maintenance, reducing IT costs and allowing the IT staff to focus on delivering new business value. As the scope of SaaS BI systems expands with more data, more users, and more applications, administration becomes a key driver in the cost of ownership.

Typically, the costs of successful BI implementations extend beyond the initial acquisition; over three years, IT staffing constitutes between 60% and 86% of BI Total Cost of Ownership (TCO). SaaS BI providers are therefore required to select a technology that minimizes staffing efforts, and consequently, reduces overall costs. A study published by Gartner Group shows that MicroStrategy customers deploy BI to more users per IT Administrator than any other BI vendor analyzed, resulting in a lower Total Cost of Ownership.

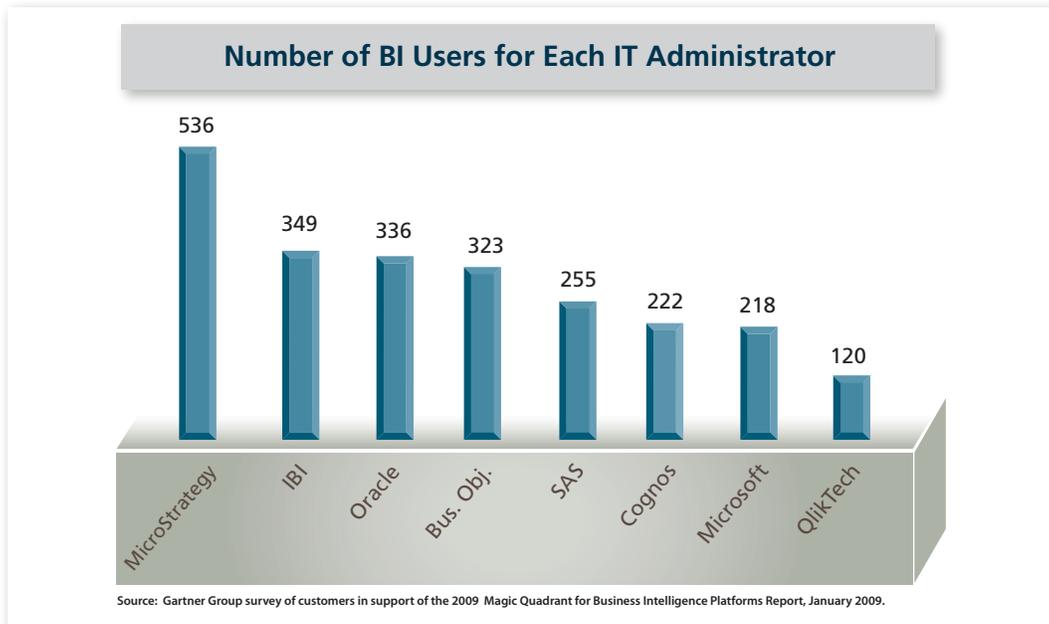


Figure 6. MicroStrategy technology requires far fewer IT personnel for a given number of BI users, because its metadata is inherently easier to maintain and because end users have more self-service capabilities that offload work from the IT staff.

Superior software architectures are set apart by explicitly incorporating visibility and controllability features into the system. Visibility is delivered through detailed and granular statistics, error logging, and diagnostic files. Controllability is achieved by providing a wide range of server and application tuning functions that let the administrator configure the system — both when first implementing the BI system and on an ongoing basis.

The key areas required for administering a hosted BI platform intended to support multiple end user constituencies, which are provided by the MicroStrategy BI Platform, include:

- Complete centralized management and configuration of the business intelligence environment
- Script-based administration and tuning interfaces to reduce manual processes, rapidly adjusting to system changes and synchronizing with third party technologies
- Fine-grained monitoring, logging, reporting, alerting, and control over the system's performance and use
- Control over the types of operations various classes of users are allowed to perform
- Testing framework enabling automated validation testing for data and report integrity across multiple environments
- Detailed diagnostic statistics to capture for troubleshooting purposes
- Real-time and historical analysis of system performance to identify trends and potential bottlenecks
- Impact assessment of proposed configuration changes and potential changes to the application definition

- Automation of all repetitive tasks, allowing them to be initiated on time-based or event-based triggers Bulk administration operations to simplify system changes, and reduce staffing investment

MicroStrategy's BI model minimizes the number of IT personnel needed to manage and maintain the technology, minimizes the number of computer servers needed to run the system, and minimizes the amount of training for business users and IT. In addition, with MicroStrategy, SaaS providers can choose to distribute a subset of administration duties, responsibilities, and operational tasks to users within individual clients. This capability allows central IT groups to relinquish routine tasks, such as user and security administration, to individuals at each client site who can be more responsive to their own business user constituencies.

MicroStrategy grew its platform 100% organically from a single code-base and optimized administration so that a single IT person could administer thousands of users. Administrators overseeing a MicroStrategy BI system have complete visibility into, and control over system performance and tuning. This detailed visibility and control is provided in an easy-to-use fashion, and designed to be extremely powerful and efficient, allowing a small number of administrative staff to manage large SaaS deployments.

VI. COMPREHENSIVE SECURITY MODEL TO DISTRIBUTE AND PROTECT THE MOST SENSITIVE DATA

Most SaaS BI implementations are strategic or mission-critical for end users. As these systems are made available to wider external audiences, information must be safeguarded from potential security threats, such as unauthorized access, data tampering, and eavesdropping. MicroStrategy addresses security requirements with an elegant architectural design that is optimized for high performance and high scalability while providing robust information security. The MicroStrategy BI platform includes its own security features in the following areas:

- User Authentication
- User Authorization, including three key subcomponents:
 - Application functionality security
 - Object Access Permissions
 - Data security
- Multi-tier Web Architecture and transmission security

User Authentication

User authentication is the process of confirming a user's identity. The MicroStrategy BI platform maintains a profile for each user of the BI system. These profiles can be created using a graphical interface, scripts with textual commands, or synchronized directly with Windows or LDAP user directories.

User authentication is done either by the user proactively providing credentials to MicroStrategy or seamlessly by using MicroStrategy's Single Sign-On capabilities (most common in embedded BI applications). Validation of user credentials during initial access can be performed:

- Within MicroStrategy using "Standard" Authentication
- Outside of MicroStrategy using "Linked" Authentication with a third-party such as Windows NTLM, Active Directory, LDAP, a Relational Database, or SAP
- Through a custom authentication mechanism via an External Security Plug-in (part of the MicroStrategy API)

User Authorization

Within any SaaS application, it is crucial to distinguish users and groups based on each individual's knowledge, business needs, and security level. Users and Groups are not granted the same rights to application functionality, reports, and data. Once a user has been authenticated, the BI system still must determine and enforce security policies governing the functionality, reports, and data for which the user is authorized. Authorization refers to the three-dimensional process by which an application determines:

- **Application functionality privileges** – often mapped through User Roles
- **Object access permissions** – applied to Users or Groups
- **Data access security** – applied to Users or Groups

Application Functionality Security

Users fall into various types, including casual users, power users, application developers, and administrators. Depending on their levels of sophistication, certain users only need basic functionality, such as running reports and sorting the results, while power analysts need to create their own analyses and publish them. Application developers need object creation privileges, and administrators require specific monitoring and management functionality. MicroStrategy employs over 130 privileges to assign application functionality to user groups, user roles, and individual users.

Object Access Permissions

Individual MicroStrategy metadata objects are governed by their own security permissions, called Access Control Lists (ACL). Each data abstraction object, business abstraction object, report component, and report definition may have its own unique ACL, which grants users or user groups a set of privileges (browse, read, write, delete, control, use, and execute) for the object. To simplify application maintenance, an ACL can apply to many objects. MicroStrategy's object-oriented metadata allows ACLs to be inherited by child objects and applied recursively. Seven permissions can be combined to grant or deny object behavior to user groups or to individual users.

Data Security

Data Security can be accomplished in several ways. These include:

- **Security filters** – Security filters provide a method for ensuring cell-level data security. All the filtering sophistication available in MicroStrategy can be used to limit the data that a user or user group can access. For every data source request, including documents, reports, and prompt lists, additional filtering criteria is automatically added to the query to restrict the result set to information that the user is permitted to access.
- **Securing data using database connection maps** – In a multi-tenant environment, organizations often need users from different tenant companies to log into separate databases. Using MicroStrategy Database Connection Maps, users can be mapped to login to distinct databases to ensure data security.
- **Database-level security** – Finally, database views may include a restriction by database login in their definition. These security views provide row-level security for every query submitted by the user. Since an administrator defines this security view inside the data source, all query tools accessing the data source with a particular login will use the view.

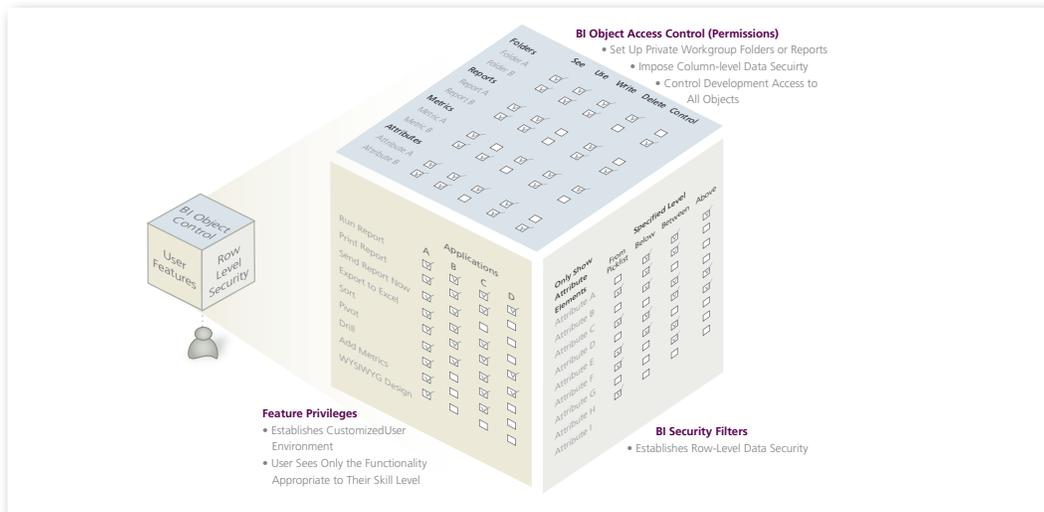


Figure 7. MicroStrategy's comprehensive application, object access, and data access security provides granular control for BI administrators.

Thanks to this comprehensive security model, each MicroStrategy user can be assigned to any number of user groups and security roles, which combined will define each user's security profile. This profile is automatically applied to every report, ensuring that all data is fully secured regardless of who developed the report or who is running it, and also enabling few reports to serve many users.

Multi-Tier Web Architecture and Transmission Security

As a Web-based reporting, analysis, and monitoring platform, MicroStrategy supports the most stringent Internet security requirements in two ways:

- MicroStrategy conforms to the most widely accepted security architecture standards by using a third generation multi-tier architecture as its foundation.
- MicroStrategy incorporates several data encryption algorithms that ensure the secure transmission of data to all users accessing MicroStrategy BI applications.

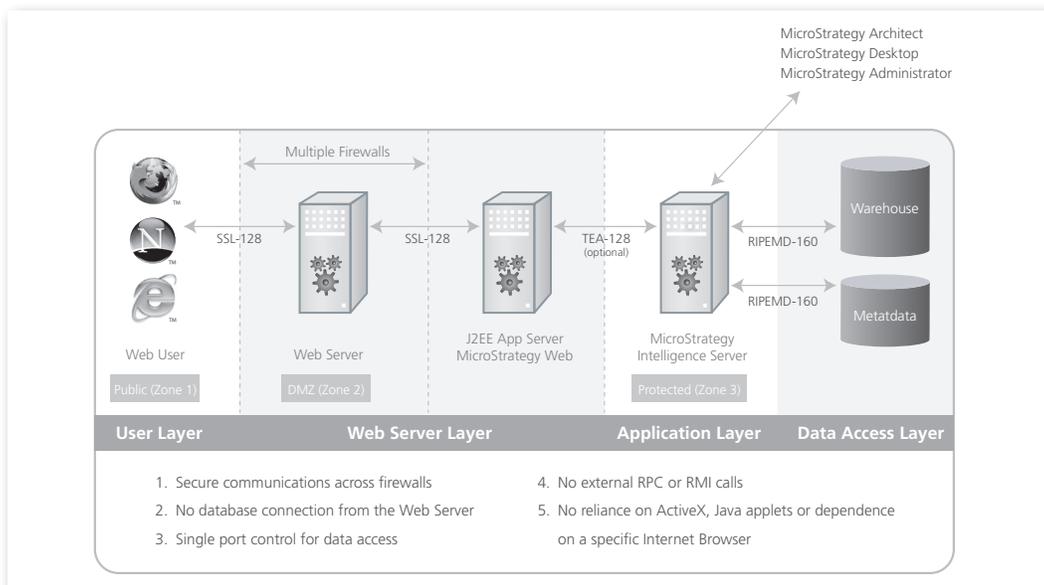


Figure 8. The MicroStrategy BI platform is optimized for high performance and high scalability while providing tight information security that satisfies the strictest requirements of any SaaS BI application environment.

MicroStrategy provides a BI architecture that enables corporations to confidently address all SaaS security requirements in a manner that maximizes flexibility and scalability, and minimizes administrative effort. Because the BI metadata presents a single cohesive model of the business, the enterprise can be assured that a single version of the truth will exist throughout all reports, dashboards, and analyses, regardless of who creates them. Seamless integration with Windows, LDAP, databases, and other third-party systems ensures that only appropriately authenticated users are granted access to the BI system. Combining data access security with application functionality privileges and object access permissions provides granular, cell-level data security that is personalized for each individual, user role, or user group. This personalized security of corporate information combines with a multi-tier Web architecture, robust encryption functionality, and a true zero-footprint client in order to offer a layered approach to protecting sensitive data in the most demanding of SaaS environments.

VII. SCALABILITY AND HIGH PERFORMANCE FOR AN ENVIRONMENT THAT CONSTANTLY GROWS

As your SaaS environment grows and more end users are brought onto the hosted system, data volume will also grow significantly. With data volume increases comes end user growth. As a result, the BI platform supporting the application needs to be scalable. Scalability is the ability to support large numbers of concurrent users accessing and analyzing large sets of data efficiently and effectively. In addition, scalability is the ability to implement more hardware resources with proportionally increasing performance. Such a system should be equipped to handle growing numbers of data tables, increasing table sizes, an escalating number of active users as well as more sophisticated analyses.

Delivering Dramatically Faster Performance at the Highest Data Scale

As SaaS BI systems grow to thousands of users and hundreds of terabytes of data, maintaining fast query performance becomes the dominant technical hurdle. MicroStrategy technology has long been the performance leader at high scale, and continues and extends that leadership with adaptive caching technology called In-memory ROLAP and new SQL generation optimizations that can deliver the highest query performance even when accessing hundreds of terabytes of data.

MicroStrategy's SQL Generation Engine is the Most Sophisticated in the Industry

Database vendors invest heavily into building Relational Database Management Systems (RDBMS) that keep up with the proliferation of data. Each RDBMS provides many strategies to deal with this trend. The MicroStrategy BI platform, with its ROLAP architecture, uses the RDBMS for much of its processing, making the most of the RDBMS investment.

MicroStrategy's SQL Generation Engine, the core of the MicroStrategy ROLAP architecture, can translate complex queries into the most sophisticated multi-pass SQL statements. Over the years, MicroStrategy has refined and enhanced the SQL Generation Engine, greatly optimizing queries while drastically reducing the number of SQL passes and overall database query time. MicroStrategy's ROLAP architecture provides both high scalability as well as high interactivity, incorporating many RDBMS-specific optimizations when generating SQL, including:

- Multi-pass SQL
- Aggregate awareness
- Materialized views, and parameterized queries
- Partitioning, clustering, and parallel queries

- Dynamic indices, statistics, and hints
- Volatile tables, derived tables, and common table expressions
- Very Large Database (VLDB) Parameters

Because of its unique ROLAP approach, MicroStrategy seamlessly works with all of these database-driven strategies for providing quick response time, while supporting massive quantities of data. Any technical advances in the database are seamlessly accessible to the MicroStrategy platform. In addition, the Intelligence Server generates efficient SQL to minimize query response time, and work in tandem with strategies employed by databases. These features are automatically applied for all users, but can also be configured to meet unique scenarios.

In-memory BI Offers a Powerful Way to Increase BI Performance

The query performance of a BI system is fundamentally governed and limited by the query performance of the underlying databases. Over the years, MicroStrategy has developed more sophisticated SQL optimizations to improve query performance for all major database technologies. Typical ROLAP systems exhibit a performance profile in which query time ranges from very fast, sub-second response times to minutes or even hours. MicroStrategy ROLAP is supplemented with dynamic caching technology that saves report instances in memory so that the next user of the same report can be served the result directly from memory, avoiding database delays.

MicroStrategy's In-memory ROLAP takes advantage of the huge addressable memory space now available on 64-bit computers to provide high performance middle-tier databases that can respond directly to data requests from reports, dashboards, and OLAP analyses. Since the new middle-tier databases are stored in computer memory, they avoid disk access delays of traditional databases.

In-memory ROLAP Cubes can offload the most time-consuming and processor-consuming queries from the database and serve them to the users much more quickly, directly from memory. The result is faster average query time and a much more evenly utilized database system.

In-memory ROLAP also frees up database capacity during interactive hours, providing better response time for database-directed queries. This additional database capacity has the added benefit of potentially allowing enterprises to delay purchasing additional database capacity to meet peak demand volumes.

Multi-Level Caching Delivers Fast Query Performance

With other BI products, query performance decreases as the number of system users increases. When caching is enabled, and since cache tuning is based on user activity, performance either improves or remains constant. More users on the SaaS system provide the BI Server with a more accurate profile of the most popular reports and data. This allows the server to more accurately cache the right data close to end users for maximum performance. MicroStrategy's Intelligence Server efficiently caches specific data in the following crucial areas:

- Metadata Object Caching
- Attribute Element Caching
- Database Connection Caching
- Report and Report XML Caching

The diagram below shows how response time dramatically decreases using strategic cache implementation within the Intelligence Server, even as the number of users increases.

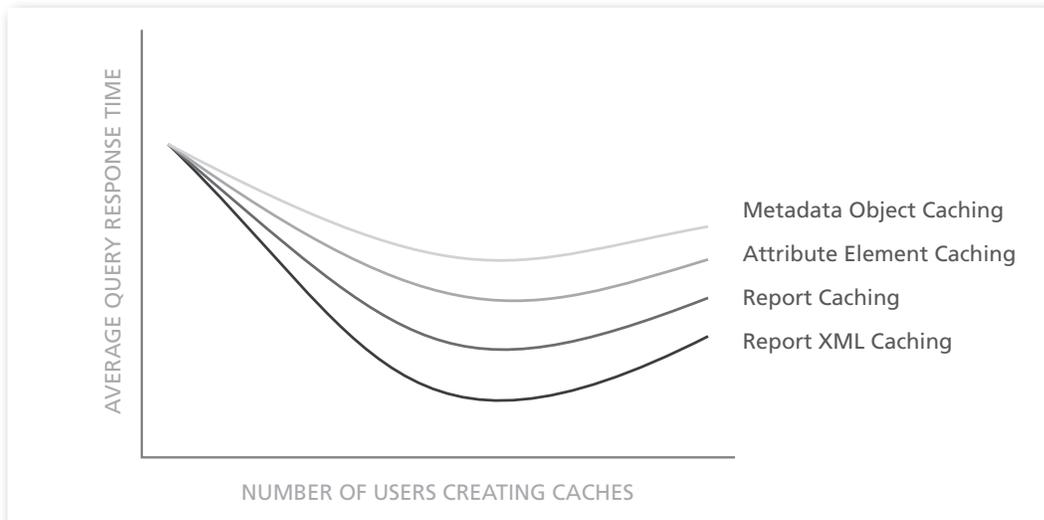


Figure 9. As the number of users increases, the query response times decrease with efficient cache usage and administration.

In a clustered Intelligence Server configuration, caches are synchronized across clustered nodes without the massive data transfer between nodes, and users connected to one Intelligence Server node benefit from the caches stored by another Intelligence Server node.

Supporting Thousands of Users

Successful SaaS BI systems often experience dramatic growth in user populations. It is increasingly common for a single MicroStrategy BI installation to support thousands and even tens of thousands of business users. The technical challenge here is to efficiently accommodate thousands of concurrent Web user sessions, while providing high performance and simple administration.

64-bit Web Servers Can Support More Users per Server

MicroStrategy's single code base supports 64-bit Java Virtual Machines (JVMs) in both J2EE Web servers as well as ASP.net Web Servers. Because each user session consumes memory on the Web servers, the dramatically expanded memory that is available in 64-bit JVMs supports many more concurrent user sessions than does the limited memory space available in 32-bit JVMs. The added memory also provides each user with greater working space to display and interact with larger reports and dashboards.

Most business intelligence vendors only offer 32-bit solutions where the addressable memory is limited to 4 gigabytes. Others may execute on a 64-bit environment but may not be optimized for a 64-bit environment, and still be limited to 4 gigabytes of addressable memory. A true 64-bit solution can address up to 16 exabytes of memory. As a result of being a true 64-bit technology, MicroStrategy BI systems can support:

- Increased user populations
- Increased performance through increased cache capacity
- Richer BI applications through increased metadata capacity
- Reduced numbers of servers

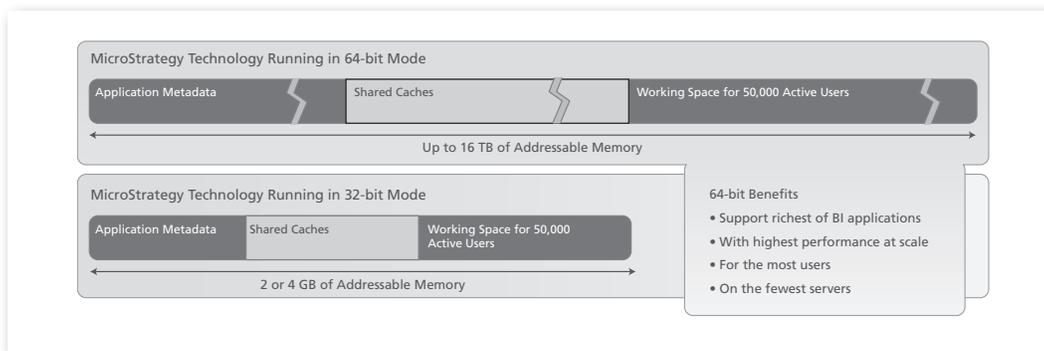


Figure 10. MicroStrategy's 64-bit technology supercharges BI, allowing more users, applications, and caches on the fewest servers.

Extreme AJAX Code Structure for MicroStrategy Web

MicroStrategy Web adheres to the "Extreme AJAX" coding model. In Extreme AJAX, processing is shifted from the shared Web server to the Web browsers using JavaScript and other techniques that minimize the frequency and data volume transfer between server and browser. These enhancements deliver a much faster and more responsive experience for business users. Extreme AJAX has the added benefit of offloading processing workload from the shared Web servers, freeing up capacity on Web servers so that each server can support more concurrent user sessions.

Clustering and Load Balancing Provide Reliable High Performance

High availability and reliable high performance are critical requirements for companies implementing business intelligence systems for day-to-day business decision making. Companies must be assured that their SaaS BI implementation is capable of delivering 24x7 availability, can scale easily, and will perform reliably under heavy loads.

MicroStrategy's middle-tier server addresses this problem by supporting asymmetric clustering, in which each Intelligence Server node within a cluster can host a different set of BI applications. This feature enables further opportunities to optimize the overall BI application, better utilizing available resources and increasing performance through:

- Further optimized resource allocation
- Added load balancing configurations for MicroStrategy Web and MicroStrategy Office
- Increased agility to react to usage fluctuations
- Enhanced failover and fallback logic

MicroStrategy's native clustering capabilities, comprehensive real-time monitoring, and ability to adapt to changing conditions offer the industrial-strength reliability and fault tolerance that are necessary to ensure 24x7 availability of the SaaS business intelligence system. Clustering at multiple levels in the business intelligence system insulates users from hardware and operating system failures, ensuring that reporting, analysis, information delivery, and transaction execution can be conducted with confidence.

Although the initial BI deployment may not be scoped to reach a large size, choosing a scalable BI platform upfront can ensure there are no restrictions to future growth. Through advanced SQL optimizations, sophisticated clustering, multi-level caching and native 64-bit support, the MicroStrategy BI platform is the only BI architecture

proven capable of scaling to hundreds of applications, millions of users, and multiple terabytes of data in order to handle SaaS BI needs.

VIII. EASE OF USE FOR A DIVERSE USER COMMUNITY

Industrial-strength SaaS BI architectures must be easily accessible and support various user types across all clients, from the most sophisticated analyst to the most novice report consumer. An intuitive, easy-to-use solution that requires little to no training encourages user adoption. At the same time, the application needs to be powerful enough to deliver relevant information to all levels of organizations, empowering users to navigate the data, and gain additional insight from their business quickly and easily, without the assistance of IT personnel. With these requirements in mind, MicroStrategy Web was designed as the primary business user interface of the MicroStrategy BI platform.

Highly Interactive, Simple-to-Use Interface for Reporting, Analysis, and Continuous Business Monitoring

MicroStrategy Web's intuitive array of manipulations delivers full BI functionality through a zero-footprint, browser-independent interface. Any user who is familiar with a basic Windows application can easily navigate information, access vital reports, perform insightful analysis, and monitor key business metrics using familiar techniques and Windows-like paradigms, such as drag-and-drop manipulations, drop-down menus, right-click context sensitive options, and one-click toolbar buttons. The highly interactive interface provides an experience that is familiar to users of Microsoft Windows while providing the advanced functionality typically reserved for thick-client interfaces.

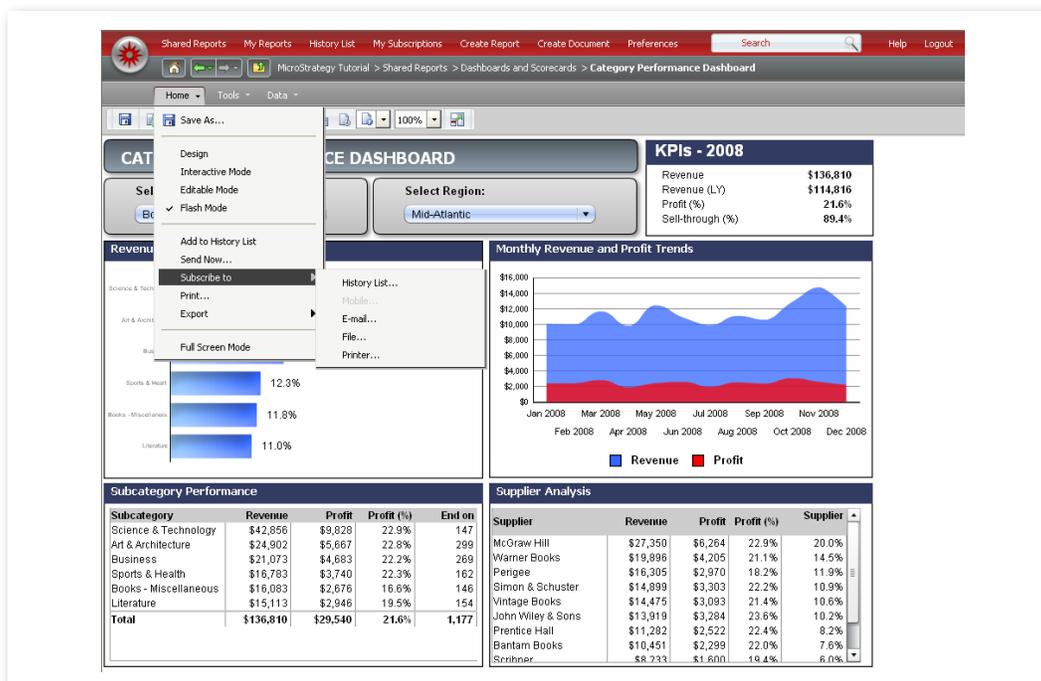


Figure 11. With MicroStrategy Web, users can easily navigate information and perform analysis using familiar techniques and paradigms, such as drop-down menus, right-click context-sensitive options, and one-click toolbar buttons.

MicroStrategy's Web architecture provides a single, consistent interface to all users whether the BI application is departmental and internal, or an extranet application deployed to hundreds of thousands of users. MicroStrategy Web allows business users of any skill level to move fluidly between all styles of BI to satisfy their reporting,

analysis, and monitoring needs. The MicroStrategy security model, as described earlier, allows user administrators to control which functionality is available to each user. Through this model, MicroStrategy minimizes the hosted provider's level of involvement with their customers by putting report maintenance in the hands of the end users. By providing significant functionality through an easy-to-use interface, SaaS providers find drastic reductions in training and support costs, faster time-to-market, and increased customer satisfaction.

Self-Service Enables Business Users to Rapidly Design Reports Themselves

A SaaS application's increasing design requirements can be met either through a corresponding increase in IT effort or through users answering their own requests through BI self-service capabilities. MicroStrategy reduces IT design activities through BI capabilities that allow a fewer number of more flexible reports, end user self-service, and design reuse, resulting in users creating and formatting their own reports without IT involvement.

Since different BI platforms provide different levels of end user self-service, efficiency, and scalability, the number of IT staff required to deploy and maintain a BI application varies greatly depending on the BI platform chosen. MicroStrategy software offers fast time-to-value through low IT development efforts and easy deployment. End users can serve the majority of their own analysis and reporting needs through MicroStrategy's self-service prompted reports and easy formatting, saving unnecessary cycles of designing activities.

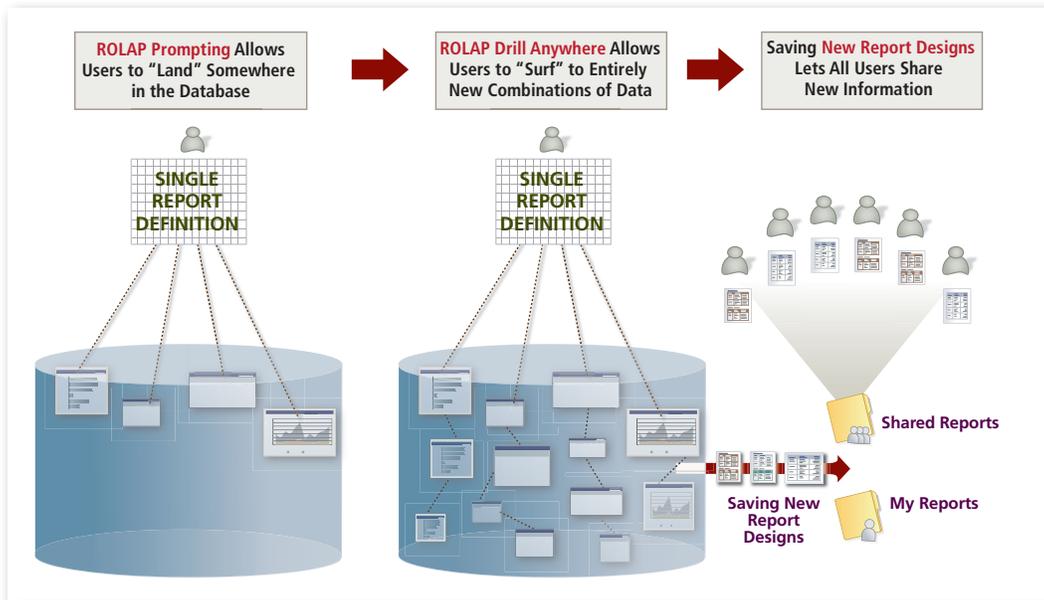


Figure 12. Using ROLAP core features such as prompting and drill anywhere, users can start from a single report design and create innumerable new combinations of data simply by clicking on the report.

With MicroStrategy, SaaS BI report developers can choose to build a small number of prompted reports that serve as starting points for thousands of potential report combinations. At report run time, users answer prompts to choose any number of desired report objects including filters and business criteria selected from anywhere in the data warehouse, as well as calculations, subtotals, and formatting. This run-time flexibility allows one report to replace hundreds of variations of report designs, without ever actually designing and storing each report variation. MicroStrategy's security system ensures that all users only see the data that they are allowed to see, regardless of who saves and shares a new report design. As a result of MicroStrategy's prompting capabilities, a few MicroStrategy report developers can meet the dynamic requirements of thousands of business users.

Additionally, MicroStrategy supports self-service through a powerful, yet simple Web interface that lets power users create any report or dashboard using drag-and-drop functionality and formatting controls that are familiar to all users' common office productivity products. Business people do not need to know any technical details about the data or the underlying databases because MicroStrategy's metadata masks the complexities of the data definitions, and the SQL generation engine can resolve even the most technically complex queries that result from users' report designs.

After executing the reports, users can "surf" the data, analyzing and investigating the information using familiar OLAP techniques, like drilling anywhere in the database; adding subtotals, calculations, and filters; and pivoting data for the exact perspective they want to see. After performing these self-service manipulations, they can save personal report versions for themselves or to share with others. To enhance usability, the MicroStrategy Web user interface adopts many familiar Microsoft paradigms, including ribbon toolbars, accordion controls, control-click multi-select capability, and context-sensitive right-click actions. The lack of these self-service capabilities in other BI products results in IT building, maintaining, testing, and upgrading hundreds of extra variations of cubes and reports.

Very few SaaS applications succeed unless the end users are empowered to do what they need to do on their own. Designed for business user productivity, the MicroStrategy Web interface minimizes the involvement of IT organizations or developers, allowing every business user to easily build, reformat, and personalize his or her own data-rich report or dashboard, without having to rely on additional support.

Consolidate the Information from Dozens of Individual Reports

MicroStrategy's Dynamic Dashboards allow business users to consolidate dozens of reports into a single or multi-page dashboard. Dashboard users can flip through many different views of the information using controls like drop-down boxes and radio buttons that are placed directly on the dashboards themselves, enabling an immense range of user interactivity with just a click of the mouse. Users do not need to learn any commands or menus in order to navigate through the data, and these controls do not require any programming in order to be set up. In addition, MicroStrategy Dynamic Dashboards boast Pixel Perfect design capabilities with desktop publishing quality for perfect on-screen appearance and perfect printing.

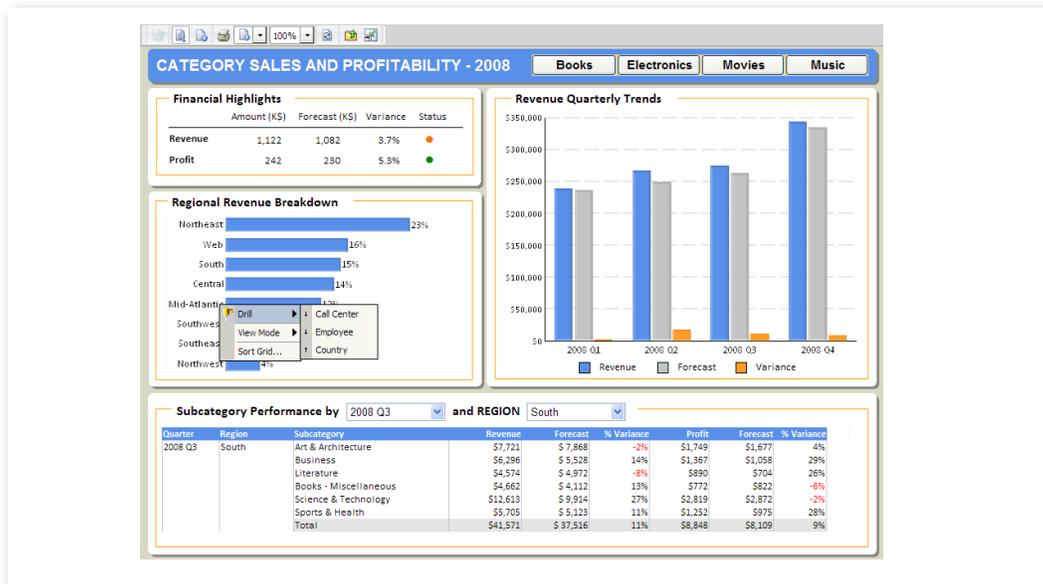


Figure 13. MicroStrategy Web users easily interact with dashboard data by using familiar controls such as buttons, combo boxes, and right-click context-sensitive options.

With MicroStrategy dashboards, users have the drilling capability without requiring any extra effort by dashboard designers. The tables and graphs within Dynamic Dashboards become immediately and automatically enabled with full OLAP drilling. The OLAP capability means that dashboard users are no longer constrained to view just the data that has been designed into a dashboard. Instead, they can use OLAP drilling commands to drill throughout the full depth and breadth of the data warehouse to obtain more detailed information or view related information.

Control Report Distribution and Information Flow

MicroStrategy Distribution Services empowers business users with the ability to control report distribution for themselves or for other users by scheduling reports via e-mail, networked printers, or directly to recipients' computers or servers. Business users are empowered to create and manage their own information subscriptions, including alert triggers, without the intervention of a centralized SaaS administrator.

Recipients of these reports and dashboards can explore data offline through Flash, HTML, Microsoft Excel, PDF or text files, amongst others. These different formats are useful for different purposes. For example, PDF documents are often used for presentation quality data summaries suitable for executive review. Excel documents are useful for additional data analyses, and are also strongly preferred by finance departments who are skilled at using Microsoft Excel.

When exporting and distributing data via Microsoft Excel workbooks, reports can be associated with the MicroStrategy BI platform using MicroStrategy Office. MicroStrategy Office serves as a Microsoft add-in, giving business users open and straightforward access to the full functionality of the MicroStrategy platform from familiar Microsoft Office applications including Excel, PowerPoint and Word. With this functionality enabled, the report results can be updated directly from the Microsoft Excel workbooks, Word documents, or PowerPoint presentations.

IX. FLEXIBLE CONFIGURATION TO ACCOMMODATE USER PERSONALIZATION AND REBRANDING

A key component of a SaaS BI platform is the ability to modify and extend the interface to meet the unique needs of each customer. A robust platform must provide the tools necessary to leverage built-in functionality that allows for personalization of the end user interface. Additionally, it must allow access to and documentation of all functionality through application programming interfaces (APIs) and a variety of programming languages, including Java, .NET, WSDL, and URL parameters.

MicroStrategy Web has been carefully and deliberately architected to make personalization and customization simple and easy, and to take full advantage of the newest Web technologies and techniques, such as Web 2.0, Flash, Ajax, Rich Internet Applications, mashups, and composite applications. The MicroStrategy SDK provides all of the tools and functionality needed to:

- Customize and extend MicroStrategy functionality and data
- Integrate MicroStrategy functionality and data into any application
- Package MicroStrategy functionality and data in powerful and compelling visual presentations

Supporting Internationalization and Dialects

In SaaS environments, different clients may require multiple language support. Even within the same language,

an attribute such as "Region" may be called different names by different customers. As companies merge and expand, there is an increased urgency for the SaaS BI environment to span all operations, across business units, across departments, across the globe, and across all end users.

MicroStrategy provides full support and flexibility for international and personalized BI deployments, presenting every report, dashboard, or OLAP analysis in the local language or dialect of each business user viewing the information. By leveraging a centralized BI metadata, SaaS providers can take a single application and deploy it in many languages, or provide different names in the same language for the same metadata object (e.g., metric).

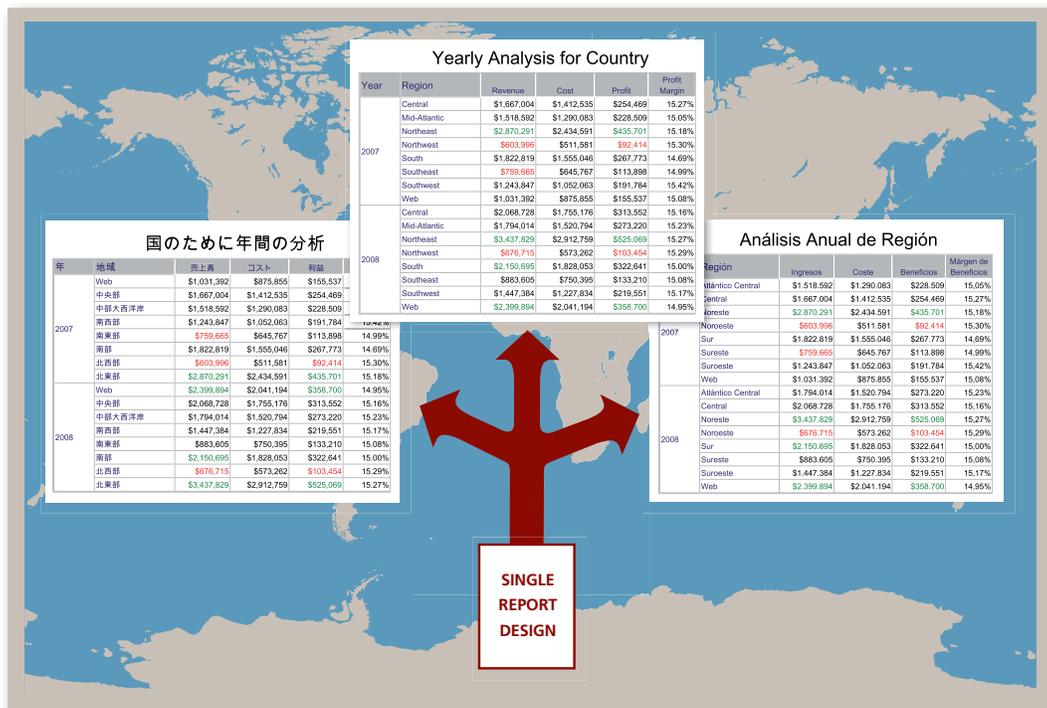


Figure 14. MicroStrategy allows every report and dashboard to be rendered in the local language of each user according to their preference.

When a user logs on to MicroStrategy, the MicroStrategy BI system reads the user's language preference from his or her browser and dynamically renders the interface, reports, and dashboards in the preferred language. This ensures that employees and customers all over the world can always access essential business information in their own language and enables more convenient and collaborative analysis across the enterprise.

With MicroStrategy, each report and dashboard design is automatically enabled for internationalization and dialects without requiring additional design work by report authors. This seamless support for global operations and multi-tenancy personalization of object names also helps SaaS providers realize considerable savings in development and maintenance costs. A single set of reports, analysis, and dashboards serves all users regardless of their local language or terminology, and there is no need to maintain duplicate applications or objects, which results in considerable savings across the enterprise.

Customizing and Extending MicroStrategy Functionality and Data

Most organizations that customize the MicroStrategy BI platform use the MicroStrategy Web API. The Web API allows customization of the MicroStrategy Web interface and development of custom Web applications that

provide interactive reporting functionality to any browser, portal, or third-party Web application.

The MicroStrategy Web's object-oriented, layered architecture has simplified the process of customization. Since the presentation layer is separate from the business logic, all the page navigation and layout specification reside in a single configuration file. Thus, it is simple to customize the interface without causing any impact to unaffected objects and functions. The majority of customization tasks involves merely modifying the values of parameters in configuration files, removing the need to program or use the API directly for the majority of common customizations.

In addition, MicroStrategy Web provides a framework, called the plug-in architecture, for plugging customization changes as a piece of software (called a plug-in) into MicroStrategy Web, so that no compilation or modification of the source code is required for deploying the customization changes. This innovative architecture design greatly facilitates the portability and management of customizations, thereby simplifying their migration when upgrading to a new version of the MicroStrategy platform. The MicroStrategy SDK's Web Customization Editor, a plug-in to the popular Eclipse Java IDE, leverages the plug-in architecture by creating plug-ins that can be easily deployed in MicroStrategy Web.

Integrating MicroStrategy Functionality and Data into any Application

The MicroStrategy SDK also provides a rich toolset to integrate MicroStrategy functionality and data in SaaS applications, including but not limited to:

- **Zero-footprint URL integration** – Parameters can be passed to MicroStrategy Web through the MicroStrategy Web URL API to perform specific actions. This makes integrating the full functionality of MicroStrategy Web into other applications, including external Web sites, portals, or other third-party applications a simple, straightforward process.
- **Support for portal integration and customization** – MicroStrategy Web report results, functionality, formatting, and user interactivity are easily integrated in any commercial or homegrown portal and with other IT applications. The integration with portal technologies stems from MicroStrategy's conformance to industry standards, such as J2EE, .NET, XML, JSR 168, WSRP, and SOAP. In addition, out-of-the-box portlets are available for the leading commercial portals without requiring any additional programming or configuration.
- **Support for security integration and customization** – MicroStrategy Web includes a customizable External Security Module (ESM) that enables integrating MicroStrategy BI data with an existing security system, and adding any logic or security requirements that any SaaS environment might need.
- **Service-oriented architecture (SOA) and Task Infrastructure** – The Task Infrastructure forms the basis of MicroStrategy Web's service-oriented architecture. A task in MicroStrategy Web is a well-defined operation that is packaged as a Web-accessible service. MicroStrategy provides a set of pre-defined tasks and also makes it easy to create and use custom tasks.
- **Visualization Framework** – The Visualization Framework supports the tight integration of MicroStrategy BI data with Adobe Flex and AJAX, and it is flexible enough to support new visualization technologies as they become available. When dynamic dashboard functionality provided out-of-the-box does not meet SaaS application requirements, the Visualization SDK helps to extend widgets and visualizations, or builds completely new widgets, visualizations, interactivity, and workflow to suit any business need.

Packaging MicroStrategy Functionality and Data in Powerful, Compelling Visual Presentations

The MicroStrategy SDK provides integrated support for Web 2.0 technology, with its focus on presenting

information from diverse sources in a unified and collaborative way via a Web browser. Newer content aggregation techniques frequently rely on Web services and service-oriented architecture (SOA), and they incorporate new technologies like Adobe Flex and AJAX. With its built-in support for all of these techniques and technology, MicroStrategy Web enables the presentation of SaaS BI data and functionality in many powerful and compelling visual presentations, including:

- **Rich Internet Applications** – Rich Internet Applications (RIAs) are Web-based applications that have the features and functionality of traditional desktop applications. The browser has become the preferred way for delivering many applications because it allows easy deployment across operating systems and simplified application maintenance. The latest MicroStrategy integration with Adobe's Flex technology complements the browser by providing the same application development and deployment benefits while adding desktop integration and local data access
- **Mashups** – Mashups combine data from multiple sources into a single, integrated Web application. Mashups access third-party data and process that data in such a way that its value to users is enhanced. MicroStrategy BI data can be one of the multiple data sources in a mashup. The MicroStrategy Visualization Framework makes it easy to create mashups that include both MicroStrategy and non-MicroStrategy widgets. Mashups that include BI data can help business users gain insight, collaborate, make decisions, and take action.
- **Composite Applications** – Composite applications combine multiple existing functions into a new application, often leveraging enterprise and enterprise-ready sources of information, such as existing modules or enterprise Web services. MicroStrategy BI data can be one of the enterprise sources of information in a composite application, enabling rich collaboration across functional boundaries, and unlocking the value of back-end systems.

X. CONCLUSION

Virtually every company relies on data analysis to find new revenue opportunities, reallocate resources, improve operational efficiency, enhance business performance, reduce costs, manage inventory, and increase sales. The MicroStrategy platform has been meticulously engineered to maximize reliability, scalability, and security. With its single code-base and integrated architecture, MicroStrategy scales to applications of all sizes, leveraging any hardware, operating system, and data source infrastructure, while making BI more approachable to business users.

SaaS BI solutions are becoming an increasingly appealing alternative for companies that need to share essential business intelligence data across the organization but do not have enough resources to implement and maintain these technologies in-house. In addition to a platform that delivers complete BI functionality, SaaS BI offerings require a higher level of security, flexibility of data access, customizability by end user, scalability, fault-tolerance and numerous other complexities that are virtually impossible without the solid underpinnings of an enterprise technology platform.

MicroStrategy firmly believes that companies ultimately want BI to support internal and external constituents, and have based almost 20 years of architectural decisions on that overarching belief. Unlike software companies that are driven by the expediency of day-to-day market trends, MicroStrategy has never wavered from its commitment to building a long-term enterprise-caliber technology and architecture, and keeping the following tenets in mind:

- **Integrated Architecture** – Support BI at all levels with one organically-grown platform with integrated architecture, powerful reporting, and a unified interface. To efficiently meet the needs of thousands of users, each with unique data, functionality, and interface requirements.

- **Rapid Development and Deployment** – Promote rapid development and deployment of new reports and applications through a vast array of reusable metadata objects, a comprehensive security architecture, and design paradigms that accelerate the report design process.
- **Reduced Administrative Efforts** – Provide a comprehensive set of tools to centrally and granularly manage and automate the BI infrastructure. Deliver greater economies of scale as a system grows. Make sure implementations require an absolute minimum of IT personnel, require the fewest servers, and minimize the workload on expensive database resources.
- **Comprehensive Security** – Provide a multi-layered security architecture design optimized for high performance and high scalability. Provide information security and a single version of the truth throughout all reports, dashboards, and analyses, regardless of who creates them.
- **Scalability and High Performance** – Deliver consistently high performance as systems scale upward, anticipating order-of-magnitude growth beyond today's state-of-the-art standard.
- **Easy-to-Use Interface to All Users** – Support BI users of all skill levels with a single and intuitive interface that enables them to easily satisfy their BI reporting, analysis, and monitoring needs.
- **Openness and Extensibility of the Complete Functionality** – Enable access to the vast platform functionality through tools, APIs, and documentation. Offer the full range of BI functionality on a single service-oriented architecture, so that customers can satisfy all of their BI requirements without the need for additional integration work.

These premises have enabled MicroStrategy to support an extensive range of BI applications, satisfying the most stringent requirements from a variety of customers and partners worldwide. Today, these same architectural tenets make MicroStrategy's BI platform the best-suited to meet the demands required for successful SaaS BI deployments.

