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The Importance, Process, and Consideration of a Data Model and Data Management Application in Delivering a Business Intelligence (BI) System for Data Performance Management

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What is Data Performance Management?

Data Performance Management focuses on managing the efficiency and effectiveness of both results and behavioral performance of the organization, division, internal and external contacts, processes, financial and many other aspects. This can be applied to different types of organizational or departmental needs and often times named within a specific focus area such as IT Performance Management, HR Performance Management, Procurement Performance Management, Customer Service Performance Management, Training Performance Management, Sales Performance Management, and so much more.

Performance Management is not just for managing employees, but it can be for IT departments managing service level agreements (SLAs), CFOs managing financial performance, CEOs managing the overall organizational performance, marketing managing advertising performance, sales managing customer performance, and training managing learning performance.

Many are afraid or even hesitant to use or even hear the word “performance management” – employees run away from it...but in reality, data performance management is a tool to help improve the process, to evaluate and strategize, and a method for communication.

Evaluating performance management is also another way of identifying and assessing the root cause of problems or issues for process improvement. Performance management if conducted properly has the ability to fix many of the core issues an organization faces.

Organizations use performance management systems called business intelligence (BI) to help communicate. This can be done to communicate IT’s performance with business users and making sure that Service Level Agreements (SLAs) are being met, or to be used as a collaborative tool to prevent poor customer performance from occurring and working together to improve customer support. Overall, it is a collaborative method to be used to improve, grow, and learn from an individual, management, and organization level by listening, discussing, analyzing, and deriving to constructive dialog communication method in achieving a common goal.

Types of Business Intelligence (BI) Systems

Users, Managers, Directors, and Executives use business intelligence (BI) systems to analyze, report or monitor based on their business needs as show in Figure 1 below.

Monitoring enables users to track performance and make decisions based on the data that is received. The types of BI systems used to monitor would be Enterprise Reporting, Balanced Scorecards & Executive Dashboards, and Alerting & Proactive Notification based on business workflow.

Enterprise reporting is designed for large volume, flexible report distribution, mostly used for detailed operational reports and adding powerful graphs to product scorecards and dashboards. In addition, there are advanced prompting capabilities allowing users to pick and choose report content.

Balanced Scorecards and Executive Dashboards provide an instant view of the performance based on the metrics and indicators defined. Many use the terms of scorecard and dashboards interchangeably. Some say that a scorecard is a performance management system where a dashboard is a performance monitoring system. Additional detail is presented in the paragraphs below to help readers understand the distinction between the two.

Scorecards identify Key Performance Indicators (KPIs) and Metrics based on an organization’s strategic initiative. Scorecards display a future perspective and measures against goals mostly used by executives; how does my goal support overall strategy? The information is summarized to give the executives a snap shot view and generally presented in a monthly, quarterly, or annually view. Strategy maps are used to help set indicators that align with

the how the organization is performing against strategic goals. Strategy maps are discussed later within this document.

Dashboards present tactical information to operational managers and provide data based on past views to answer the question of why goals were not met? It is a system that allows management to visualize the day to day operations and apply business process improvement where necessary. KPIs used in dashboards bring to light operational milestones.

Scorecards and dashboards can now be combined and used interchangeably in today's modern business intelligence systems. The objective of both is to be able to understand the information that is presented in graphical view and resolve underlying issues immediately. When executives use a scorecard to measure the performance of the organization and drills down to see what the root causes could potentially be, a dashboard view is presented to identify the operation status of the problem. Plus a vice versa effect can take place where management can view a dashboard to solve the problem from an operational level and then monitor the result from a scorecard.

Alerting and Proactive Notification monitors' red zone activity based on threshold levels set and notifies individuals. With monitoring we see how data can transition to information, and how information is translated to facts and/or knowledge, and how knowledge can then become action, triggers or events.

Reporting delivers the data on historical and current information allowing users to view overall organizational performance.

Analyzing represents different views from different angles to decision makers allowing them to address root cause or conduct predictive analysis. The types of BI systems used to analyze would be OLAP slice and dice and Relational OLAP Analysis and Advanced & Predictive Analysis.

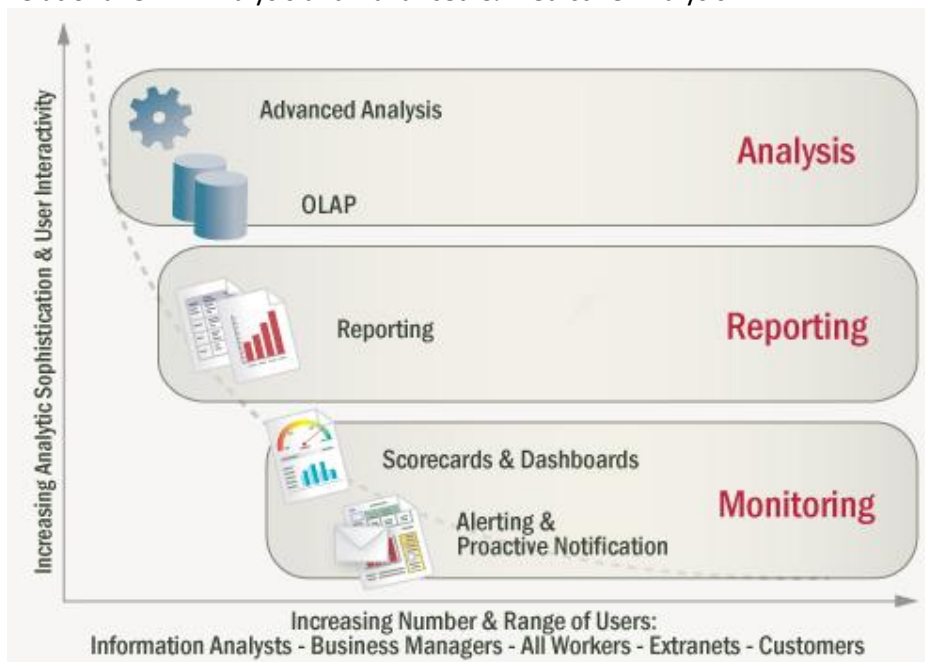


Figure 1 – Types of Business Intelligence (BI) Systems

MicroStrategy categorizes and delivers all BI system types into what is known as the *5 Styles of BI*:

1. Enterprise Reporting (Monitoring & Reporting)
 - Balanced Scorecard
 - Executive Dashboards
2. Cube Analysis (Reporting & Analysis)

- OLAP Analysis & Relational Data Warehousing
- 3. Ad-Hoc Query & Analysis (Reporting & Analysis)
 - Relational OLAP (ROLAP)
- 4. Statistical Analysis & Data Mining (Reporting & Analysis)
 - Advanced & Predictive Analysis
 - Cause and Effect Relationship
- 5. Alerting & Report Delivery (Monitoring & Reporting)
 - Proactive Notification

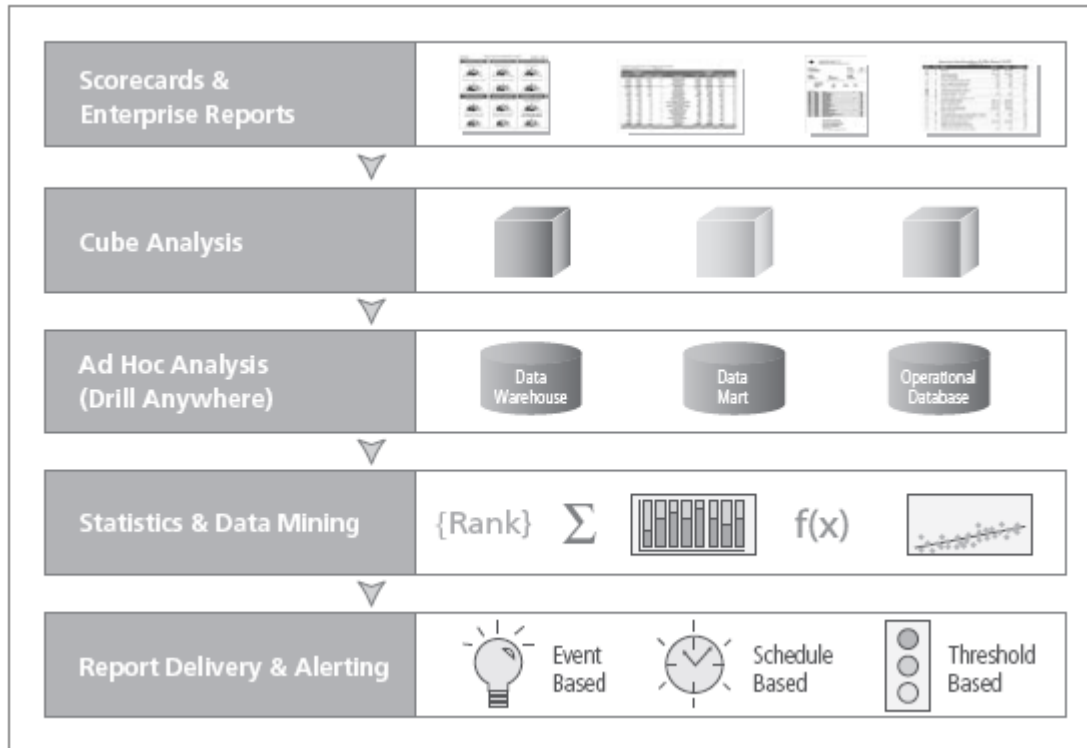


Figure 2 – MicroStrategy 5 Styles of BI

Benefits of Data Performance Management

Often times when talking to executive managers, they express that their staff gives them data, but not the data that they need to make informed decisions. Sometimes the information is provided only after a big problem or issue has occurred. What causes this? It is based on the definition of what is important data to the individual needing it and the timing of the data to be provided. If everyone had the same definition and understanding of the type of data, importance of the data, and timing of the data, then management would be able to make informed decisions and avoid conflicts. Most of the issue is based on the fear that many believe reports, business intelligence systems, and analytics to be used against employees instead of a tool to evaluate and diagnose what causes mistakes or issues to arise without pointing fingers or playing the blame game. This needs to occur in order to help prevent future problems from arising.

Data Performance Management also helps organizations meet compliance such as SOX, rules and regulations, identify the importance of how individual work impacts others causing morale to improve, and address issues to perform process improvement.

There are many other benefits to Data Performance Management. Executives and managers are enabled with a tool that helps them interpret data to communicate strategy with peers, and can be tailored to communicate with other internal business units, employees, and external parties. This also promotes a healthy dialogue between managers and employees about performance results and forecasts, making it easier to conduct a more regular

and productive performance review.

When establishing the requirements of the executive and management objectives, goals and targets and how they want their information displayed on their Business Intelligence systems, they are able to monitor and execute strategy based receiving data in a quarterly, monthly, weekly, daily, hourly, and even real-time approach. This gives them visibility into operations and future performance by forecasting trends based on historical activity.

Once the requirements of the data have been determined, the design aspect is important for how the data is displayed using graphical charts, symbols, and colors. This is to help executives and managers graphically display information that makes sense to them to interpret and being able to drill down to discover additional detail about the data to find the root cause of the issue.

Government Performance and Results Modernization Act

On January 4, 2011, President Obama signed the Government Performance and Results Modernization Act of 2010 (GPRAMA)¹. The GPRAMA requires the head of each government agency to appoint a Chief Operating Officer (COO) and a Performance Improvement Officer (PIO) to improve management and administrative functions while reducing cost. The task is in identifying opportunities to reduce potential duplication in government programs, save tax dollars, and enhance revenue. The law requires agencies to notify the public of strategic plans that address the mission statement, measurable and targeted goals and objectives that are aggressive and can be achieved within two (2) years. Constituents want to know how their tax dollars are being spent and what they are getting out of the spent money.

The GPRAMA is to be used as a tool to “help ensure that these strategic efforts are not a feckless paperwork exercise but meaningful tools to promote efficiency and effectiveness in day-to-day operations” according to Senator Susan Collins (R-Maine), one of the bill’s co-sponsors.

The GPRAMA is to help address the Federal Performance and Management Challenges. As organizations such as healthcare, transportation, insurance, banks, hospitality, retail, education, and much more are seeing more and more value in performance management, the US Federal Government has recently passed a law requiring each agency to take action towards the improvement and stressing the importance by making sure each agency assigns two designated officials to the program. This fact by itself makes a strong statement for why this whitepaper was written.

Issues Addressed

The overall success of an organization is through the productivity of its employees. It has been proven time after time that when employees are skilled and motivated they are more productive at their work. When executives **communicate** the overall organizational strategy to department heads and in turn that information is translated into tactical operational day to day for managers and their staff, employees can then see how their role has an impact to the overall goal of the organization. Therefore the large goals and vision of the organization can be translated and communicated to actionable activities across various departments and trickle down to the staff.

The communication being addressed here is not to be looked at as a blame game but to uplift and encourage employees and to address root cause issues for better process improvement. For example, what are the root cause and the reasons why a certain airport has filed several incident and investigation reporting within the last month? Is it due to lack of staff training, volume of air traffic, older equipment, or not enough resources available during busy holiday season? Furthermore, the data can also reside in several data sources such as the Aviation Accident database, Air Claims database, Traffic Flow Management System (TFMS), and others.

Performance management also helps address **data integration, data quality, and data redundancy** concerns within the organization. When identifying the data needed from the various data source, it can help identify

¹ The White House (Jan 2011) *Performance & Personnel Management*, <http://www.whitehouse.gov/omb/performance/gprm-act>

replication and inconsistency of data across applications and systems. For example, the data to pull the hours of duty of an air traffic controller can be drawn from multiple sources; 1. a time recording system when the controller clocks in and out of duty, 2. the roster plan, or 3. the payroll system.

When there are measurement difficulties due to **Service Level Agreements (SLAs)**, these are identified easily when using performance management. Service Level Agreements (SLAs) are important when measuring performance where inputs and outputs need to remain consistent. For example if there are contractual arrangements with one airline for a fixed amount of payment to an airport based on certain limited usage and then another airline pays for service that is distributed across a territory used across multiple airports, demonstrates that there is inconsistency between the different airlines on how revenue is received. The same is true for inconsistency between costs incurred.

Steps from Data Model to Business Intelligence (BI) & Mobility

Figure 3 below reveals a step by step of what it takes in delivering a performance management project to executives, department heads, managers, and staff members.

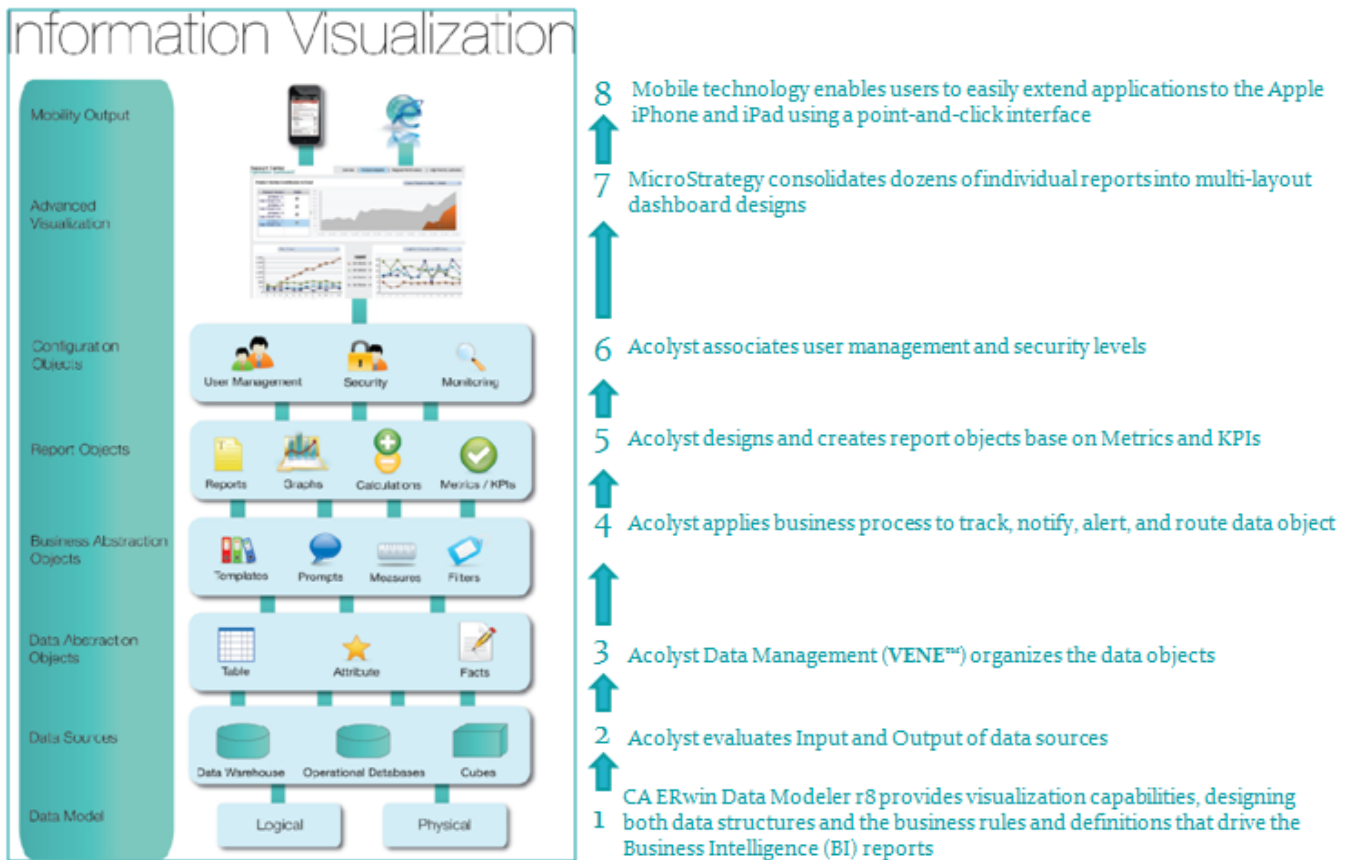


Figure 3 – Information Visualization

Data Model

A successful performance management project requires a data model to help make sure the data definitions are consistent, identifying the relationships and interactions between organizational units, its customers, involved parties, partners, and suppliers.

Modeling a system provides both a high level and detailed view of the underlying data. For example, when determining the number of incoming passengers per flight, is that information located within the airline data source or the airport data source? Is the passenger information in a different data source?

A specific Data Model needs to be created for a Data Performance Management requirement as many of the data

within a data source is not needed and it is important to identify data specific to the report requirements for a Performance Management project. In addition, when determining the metric or KPI, it is important to understand where the supporting data is derived from. Many times in order to calculate a metric against one or more dimensions an aggregate data needs to come from several different data sources. For example payroll system to determine if a personnel is a full time employee (FTE), part time employee (PTE) or contractor and HR training system to determine the personnel skill level and certifications achieved and/or training classes pending.

Logical Data Models are important in understanding the inputs that are necessary for a business intelligence system. Logical Data Models helps determine the location of the data source and the five (5) categories of data needed for a Business Intelligence system:

1. Historical Internal (company) Data (from operational systems)
2. Forecast Organization Internal Data (financial and non-financial)
3. Historical External Data
4. Forecast External Data
5. Target Values

As the report requirements change, so will the logical data model. The data source needs to be considered and if there are data that is not in existence a gap analysis identifying what is currently available and what needs to be considered for the future needs to be documented.

The Logical Data Model also helps determine which data schema objects and abstractions are needed and their respective relationships. These are facts, attributes, and hierarchies. Facts are values that are numeric and aggregation functions (sum, average, minimum, maximum, etc.). Attributes represent characteristics or values. For example, the attribute of a flight boarding pass might include the passenger name, flight number, terminal and gate number, and seat number.

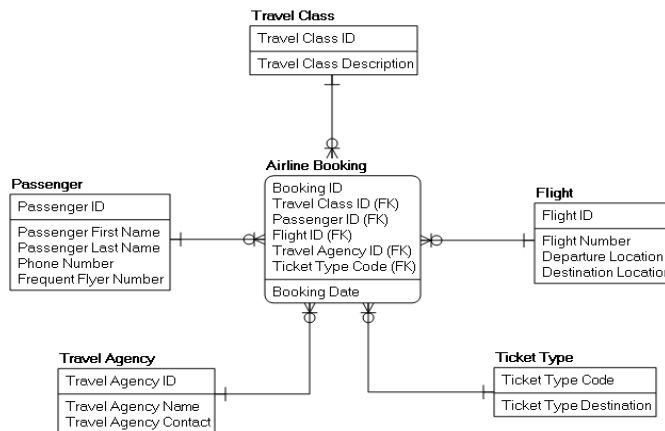


Figure 4 - CA ERwin Data Modeler defines Core Business Rules and Data Structures

Hierarchies are important to understand and have defined to be able to pull in necessary information needed for metrics. For example if a metric is used to determine the productivity of Air Traffic Controllers on duty for every hour, that metric can be portrayed in a number of ways. A metric has a measure and dimension. In this scenario, the measure would be the number of movements controlled and the dimension would be in terms of hours. The dimension could also be displayed in weeks or month to demonstrate a pattern, trend or historical information.

A multi-dimensional analysis can also occur by evaluating a measure against more than one dimension. For example the number of movements controlled by full time staff and hours worked. This slice and dice method is referred to as multi-dimensional OLAP (MOLAP).

Once metrics are defined, they are used to produce performance indicators. Key Performance Indicators (KPIs) are metrics that are tied to targets. Targets are plans that are provided allowing users to instantly determine where they actually are against their target (actual vs. target). The targets are determined by the organization setting realistic goals and/or based on comparison set by external factors or benchmarks. For example, to meet a certain target of movements controlled, the size of the airspace controlled needs to be taken into account. When comparing the number of movements and determining the target, the volume of traffic controlled based on the number of landings and take-offs that the airport can handle would need to also be considered.

Data Management Application

In order to improve business processes and produce an effective performance management to the goal and vision of the organization, the data that is not being captured needs to be identified. Oftentimes organizations need to step 'out of the box' and identify data necessary to help their organization broken down by different departments. For example, data on employee productivity for air traffic controllers can be captured using several HR systems in the organization such as payroll, training, and performance review. However, what about applying a data management application that addresses the tasks, duration, air traffic controllers involved, and action items and tracking of activities to help determine resource workload? Data management applications are important to use to improve business process and address the needs for additional data by creating, editing, and saving the data throughout different departments.

Figure 5 – acolyt's VENE Data Management Application

Data Performance Management Inputs & Strategy Map

There are many inputs to a Data Performance Management such as internal data like Service Level Agreements (SLAs) and financial cost models, operational data like size of airspace and traffic mix, and external data like benchmark and comparable airport's measurement information. In addition, there are exogenous information used as inputs like regulatory and legal constraints and government control. For example, safety regulation, volume of airspace, and workforce requirements.

The inputs are organized into a strategy map. Strategy maps are communication tools that show the logical step by step linkage between strategic objectives in the form of a cause and effect relationship. In performance management projects leading, lagging, and problem-oriented metrics need to also be considered.

Financial	Ensure airspace system is safe and efficient	Be better stewards of public funds	Support economic growth	Assure a sustained and affordable air traffic system
Customer	Safety Improvement Operational Predictability	Make the NAS more cost effective Maintain trust with Customer and owner	Build capability safety to meet demand	Deliver a future air traffic system that meets customer operational needs
Internal Process	<ul style="list-style-type: none"> ↑ Ensure Safety & aircraft separation ↑ Manage airspace use & traffic ↑ Optimize service availability 	<ul style="list-style-type: none"> ↑ Reduce unit cost of ATO ↑ Increase ATO productivity ↑ Invest in positive return solution 	<ul style="list-style-type: none"> ↑ Implement airspace capacity safety ↑ Refine separation standards ↑ Identify & prioritize airspace & airport initiatives 	<ul style="list-style-type: none"> ↑ Develop & execute ATO Business Process ↑ Collaborate with partners ↑ Develop alternative concept ↑ Enhance business measurement
Employee Learn & Growth	<ul style="list-style-type: none"> ↑ Plan, execute across organization ↑ Enhance employee commitment through management 	<ul style="list-style-type: none"> ↑ Train to gain additional skills ↑ Use financial info to manage effectively 	<ul style="list-style-type: none"> ↑ Encourage innovative thinking to align resources with demand 	<ul style="list-style-type: none"> ↑ Foster value driven workplace

Figure 6 – Simple Air Traffic Organization Strategy Map

From the Air Traffic Organization example above, there is a cause and effect relationship which is used to evaluate and help refine the strategy. The strategic objectives and performance measures are derived from the vision and strategy of the organization. The framework includes financial performance resulting from customer satisfaction, customer satisfaction comes from internal business process improvement, and the internal business process is drawn from innovation and creativity through the evolvement of employee learning and growth.

Within each four of the hierarchical framework perspective includes four components which are objectives, measures, targets and initiatives.

Financial	Objectives / Measure / Targets / Initiatives
Customer Satisfaction	Objectives / Measure / Targets / Initiatives
Internal Business Processes	Objectives / Measure / Targets / Initiatives
Learning & Growth	Objectives / Measure / Targets / Initiatives

Figure 7 – Hierarchical Framework Components

Design Visualization Considerations

Design visualization is presented in graphical and chart formats. It is how the analytics of the data is presented for the user and what the user decides to do with the information they have and how to communicate that information, whether it is predictive analysis, forecasting or making strategic decisions.

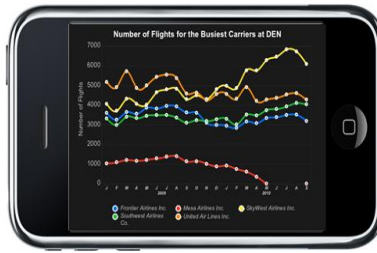
The main question with designing is, can the information provided be interpreted to the needs of a specific user and can they make decisions based on a particular view? Scorecards use symbols and icons while dashboards use graphs, grids, gauges, etc. A combination is used for an integrated scorecard / dashboard reporting with different types of measures such as percentage (%), number (#), and ratio (:).

There can be over 100 graphical styles to present the data in a grid and graph view. There are some common

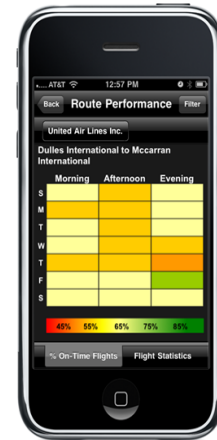
views used for effective communication. In addition, there are other features that are embedded within a business intelligence system such as video stream capability.



Bar chart is used to compare multiple quantitative series of data.



A line chart is used to demonstrate trends over a period of time.



Heat maps are used to represent attribute elements and quickly view several variables at once.

There are several other design types such as gauges, bubble charts, traffic lights, time series slider and many more. An important consideration the designer needs to keep in mind is the real-estate space of the screen and ease of use for the various display methods and types. For example, the display on a desktop would be different on a laptop depending on its size, and a Netbook.

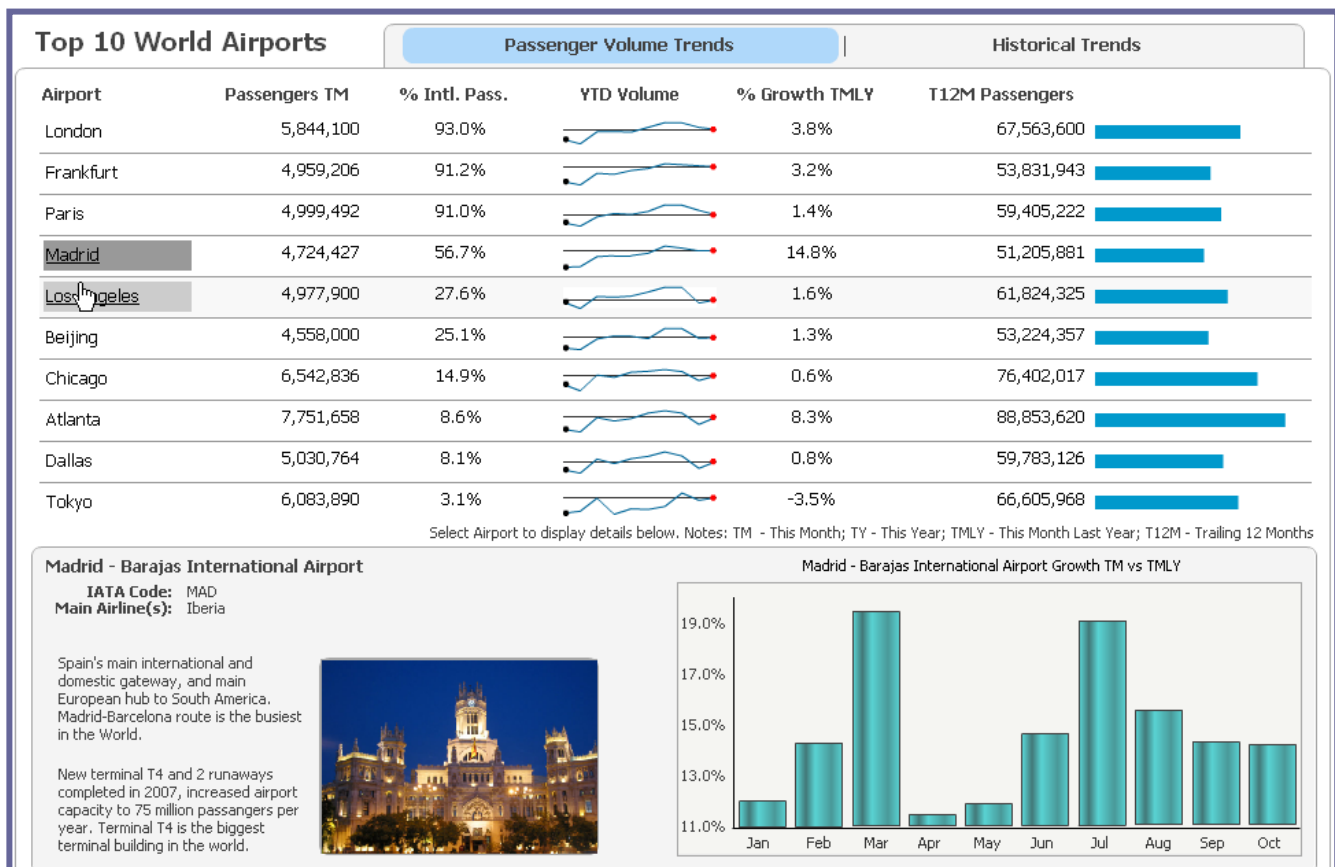


Figure 8 – MicroStrategy Desktop Dashboard Sample

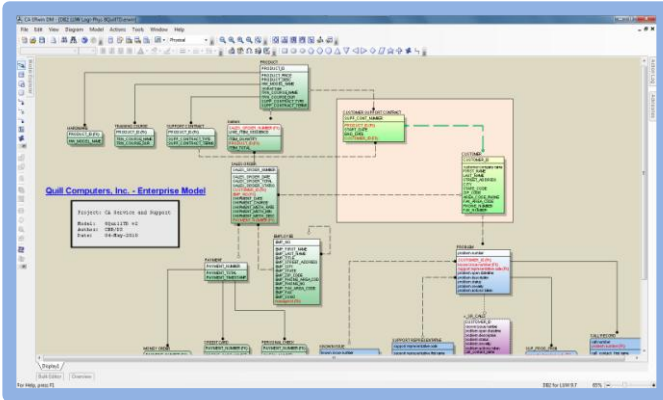
The same needs to be considered for iPad and iPhone models as well. The ergonomics, coloring and the implications with navigational concepts are important when not crowding the space yet making the information readily available.



Summary

A Data Performance Management project is most successful when implemented using agile and iterative practices. Agile and iterative design methodology is based on cyclic process of analyzing, prototyping, testing, and refining a product or process. Starting with a robust design of the data and business requirements with a data model puts the project on the right track by saving project time and money in avoiding rework and minimizing changes in the long-term. The prototyping can be a combination of a low or high fidelity. This enables organizations to streamline the process and expedite the design. An iterative approach allows for more success since it focuses on a fraction of the business unit and keeps the scope small and manageable. A successful project can then be expanded out to more successful projects where individuals want to be engaged and part of the success and the vision of the executive leadership team. Each small project allows for an evaluation and lessons learned to occur and documented in order to revise and modify the process for that specific organization. The trick is to make sure the smaller implementation projects are conducted through repeated cycles and incrementally so the momentum of the overall project is not lost but instead gains quicker and measurable results.

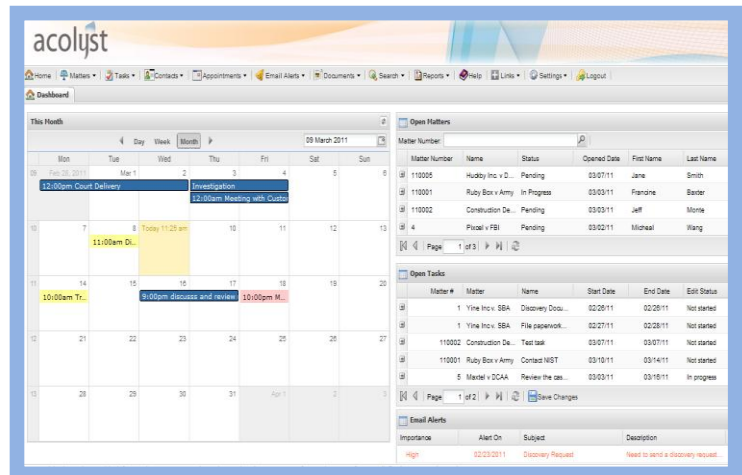
About trilyst™: acolyst, CA Technologies & MicroStrategy



CA ERwin® Data Modeler r8
 Industry-leading data modeling solution that provides a simple, visual interface to manage complex data environments.



acolyst's VENE™ Data Management
 Mastering data enables organizations to effectively create, capture, manage, track, process and utilize information associated with contacts, contents, records and much more...



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Bio

Valeh Nazemoff serves as Vice President of [acolyst](http://www.acolyst.com) where she is responsible for managing several multi-million dollar projects simultaneously, working with client executives in meeting their strategic initiatives, and helping them plan and roadmap their data performance management while implementing industry standards and best practices. She also teaches several business courses for the University of Phoenix Online (UOPHX). You can reach her at valeh@acolyst.com.

