A Link-Systems International, Inc. White Paper

Information Visibility Services™

Improving Data Management Outcomes

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About the Author

Link-Systems International, Inc. (LSI) develops, hosts, and maintains a battery of distance learning tools and services. Information Visibility Services is the data-mining and presentation tool offered by LSI to educational institutions and their corporate partners, such as publishers. LSI was founded in 1996 by a group of mathematics professors at the University of South Florida in Tampa, where LSI is still based. Michael Turner, leader of the original web design team at LSI and project lead for Information Visibility Services, has been involved in the development of many of the company's services, including Online Content Services, NetTutor Online Tutoring Service, and Information Visibility Services.

This paper examines the factors which make Information Visibility Services vital to today's data-driven enterprises. The paper shows how the service enables an enterprise to extract the maximum value from the data it may be accumulating without additional investment in infrastructure or risk to security but with promise of an easy to manage presentation of critical data in real time for assessment of employee performance, pattern detection, and alerts in real time to critical changes in the data.

Information Visibility Services™ *Improving Data Management Outcomes*

Overview

Enterprise data sources and collection techniques continue to multiply; data storage requirements, for some institutions double every two years (Schumacher). Information Visibility Systems, a data-mining and presentation tool offered by Link-Systems International, Inc. (LSI), assists enterprises with a variety of data storage in place realize a substantial return on investment and add value to sunk costs by deriving benefits from information being collected but going unused. Budget constraints and the need to comply with data-driven standards make it critical to extract the maximum value from collected data. Information Visibility Services does just that: it provides increased accountability with a system of alerts, it presents data in a meaningful dashboard format, and it helps detect patterns in data from disparate sources–all without an investment in new infrastructure.

Background

A recent article in *Inside Higher Ed* summarizes the findings of the 2011 *Presidential Perspectives* survey of college presidents in the United States. According to the authors, college presidents voice their dissatisfaction with the effectiveness of their information technology infrastructure (Lederman & Jaschik, 2011). Likewise, for publishers who serve the education industry and compile multitudes of databases from millions of potential collection points, data proliferation threatens to reduce executives to data administrators (Mayfield). The recognition of the power of retaining data has given way to a new technical dilemma for enterprises and, in particular, for educational institutions and their corporate partners. An overload of information sources threatens to hamper the operations of any enterprise that needs to access data from multiple data sources.

The primary source of information overload for enterprise decision-makers is the range of brand-names of databases even after years of consolidation in the industry: Oracle, SQL Server, Microsoft Access, MySQL, DB2, and Paradox are just the most established of these vendors. Each database has its own database management system (DBMS). Each DBMS is isolated from others by its proprietary communication protocols. Further, a DBMS cannot manage data that is embedded in another system. The result: an administrator who, for example, would like to correlate grades from a learning management system (LMS) to human resource data such as time in grade would likely find that the two pieces of data are stored in isolated systems.

These technical difficulties are compounded by additional bureaucratic barriers. New laws protect student privacy but introduce barriers to data sharing. Similarly, financial and health data are also protected by law. The difficulties in correlating such data are well known to the executive officers of enterprises, but they could do little about it until now.

Link-Systems International, a pioneer in Web-based distance-learning solutions, has grown increasingly aware of these issues. Its online education platform, the WorldWideWhiteboard®, has been used at many schools since 1995 to conduct online courses and for online conferencing; its online tutoring service, NetTutor® has allied closely with educators and textbook publishers since 1996 to deliver support outside the classroom. With a growing profile in education reflecting the increased use of Web-based technology in the twenty-first century, LSI was uniquely postured to understand the requirements of data presentation in educational institutions and their partners. The company aimed to design a service to meet the following parameters:

- The service must transparently make all types of data available to decision-makers.
- The service must provide maximal security to allow for the integration of data that has legal restraints on its access.
- The service must alert users to decisive facts revealed in the information they are accumulating.

LSI worked with its development partners to shape a new tool for organizing and presenting enterprise data which meeting these requirements. After extensive research, testing, and review, LSI launched Information Visibility Services in 2010.

The Solution

The primary advantage that Information Visibility Services offers institutions is the patented ability to span multiple data islands, taking in and displaying in a meaningful manner data from diverse departments. Providing, a robust combination of design and security features, Information Visibility Services enables decision-makers to quickly assess issues such as quality improvement, productivity, and economy of scale. Data collection, through the portrayal of trends and performance, can then drive the efficient implementation of existing policies and make possible the elaboration of new policies in better correspondence to the actual data.

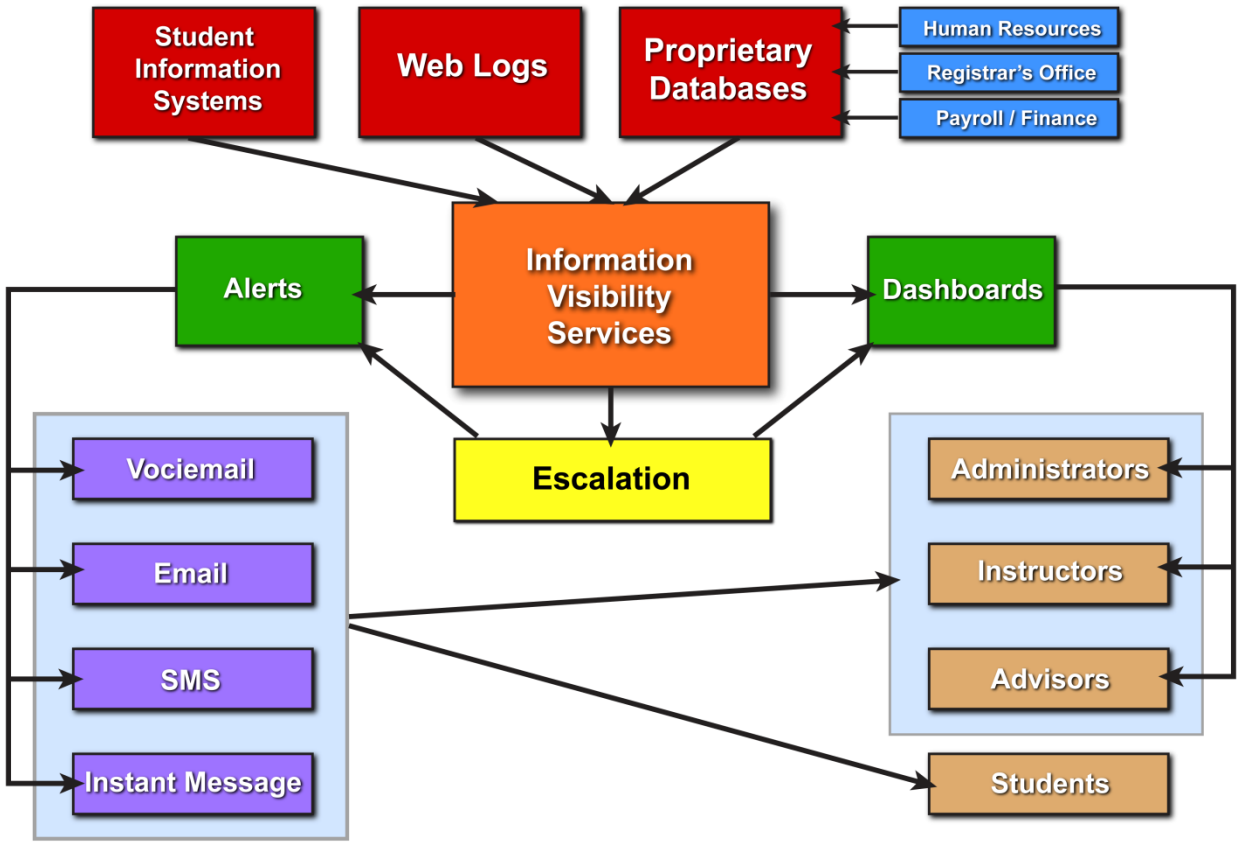

Figure 1. Information Visibility Services Process Flow

Information Visibility Services creates a layer of business intelligence on top of existing data investments. Combining data interoperability with real-time analytics, Information Visibility Services generates maximum value from the data that exists within an enterprise. The tools provided by Information Visibility Services provide an overarching solution to the problem of making use of enterprise data by relating and integrating metadata–data about the data–in structures known as crosswalks (Gill, Gilliland, Whaley, & Woodley, 2008). Whether stored on dissimilar hardware, formatted according to the needs of different DBMSs, or even derived from agencies facing dissimilar data-security regulations and practice, Information Visibility Services can consistently bring the information together and do so using noninvasive data acquisition techniques. Ultimately, real-time information response can be disseminated to all levels of staff and stakeholders from existing data warehousing.

Data Agnostic Approach Secures Data for Merging and Analytics

Information Visibility Services is data agnostic, which means that its operation is indifferent to where data comes from as well as the data type. It can process data from multiple sources without regard to data format or database brand, allowing all data analysis and collection to be performed at the source. By simply tagging data with extensible markup language (XML) when necessary, it facilitates data transfer for immediate presentation. The same principle allows for data to be precompiled and for business rules to be applied in determining, for instance, whether it should be temporarily placed in a

keyed data store. An example is the calculation of grade averages from a source record, where large amounts of data results need to be continuously processed to yield up-to-date values and where the calculation is computed externally to Information Visibility Services. The service makes results of the calculation available instantly.

Analytics Translates Data Sets for Processing

Information Visibility Services operates across various remote data sources. It uses selective data acquisition to create, organize and replenish a single repository of data. Once assembled, Information Visibility Services displays the data result set or generates notifications and alerts.

The service uses heuristic algorithms to identify business conditions defined by the user. Algorithmic results based on previously defined patterns form the basis for identifying areas of concern and topics of interest that require review.

Due to the data agnostic approach of Information Visibility Services, the results displayed are *not* required to be limited to one data source at a time. As will be seen, comprehensive dashboards may combine the data from multiple sources into one summary view.

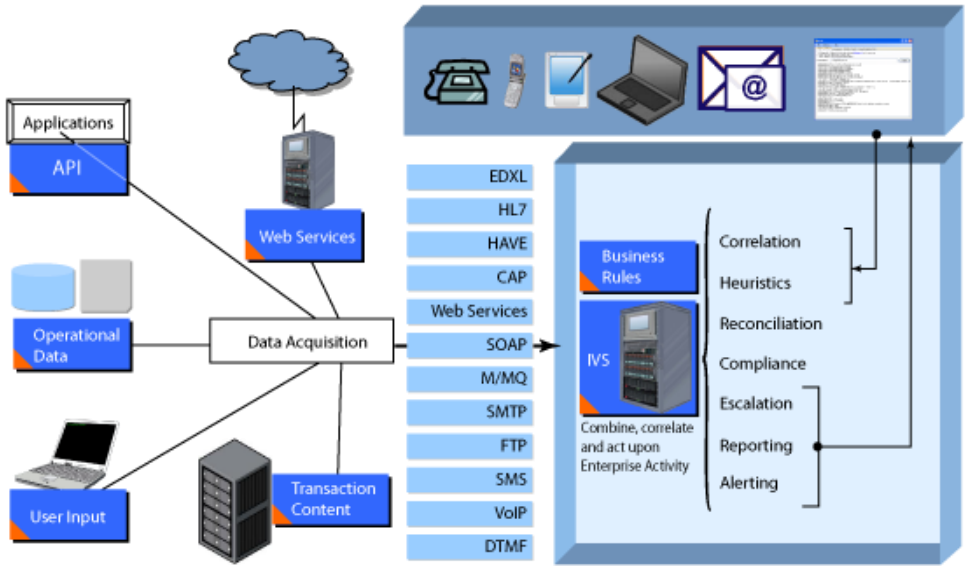

Figure 2. Processing and Analytics

Client-Defined Processing Prepares Data for Visual Display

Information Visibility Services extracts only data necessary for analytics from the preexisting data sources and does not reproduce the original data warehouses. This carries with it three major benefits not found in the original DBMSs.

First, current or staged data can be operated on in real time based on data handling rules provided by the users. Tremendous added value is offered for business intelligence specifically by bridging multiple data sources of any type, format, source, or location. The correlation of disparate data sources in real

time adds depth and value to existing infrastructure regardless of brand of database or the data types they store.

Second, it preserves the integrity and acknowledges the security concerns tied to the original data sources. Its features, including the detection of the presence of user-defined data conditions and the generation of alerts, do not compromise the privacy of the underlying data. Mining the data and tracking results from multiple autonomous sources, Information Visibility Services constructs a view of data results in real time that leaves all data collection and protection procedures untouched.

Finally, as a data acquisition and interoperability data solution merging data from disparate systems, Information Visibility Services enables the use of that information to its best effect. Stakeholders and subject matter experts decide the metrics to be implemented and the business rules to be used to generate solid results. In accepting user inputs into its analysis, Information Visibility Services treats the decisions regarding rules as simply another user input; the rules, not the data, shape the decision trees that are used to create dashboards, alerts, and determine risk factors.

These features provide the enterprise with an otherwise unachievable level of instant accountability. Taken as a whole, Information Visibility Services, due to its data agnostic approach and solid analytics, is a process that is granular in approach and well adapted to real time tracking of success criteria.

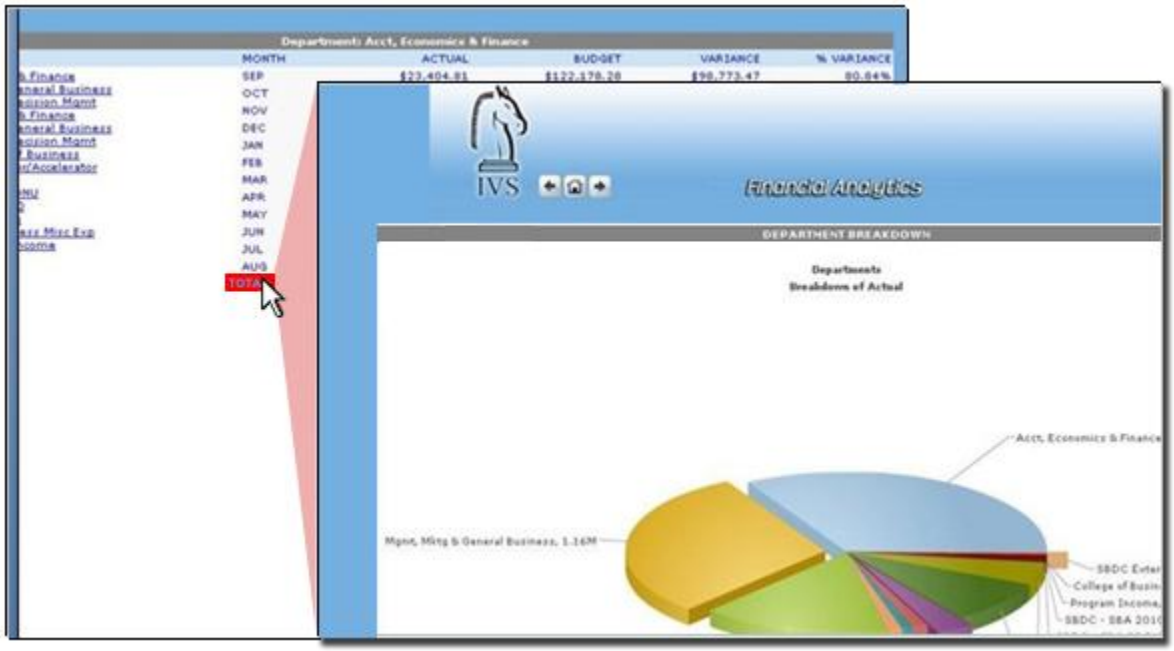

Figure 3. Visual presentation of data

Multi-Tiered LSI Support Ensures Operability

Once adopted by an enterprise, Information Visibility Services enjoys the full backing of the Link-Systems support team. Developed to meet the demanding environment of technical support for online learning, the LSI help desk and technical team ensure the smooth operation of Information Visibility Services and user access with telephone, Web form, and email support channels.

Help desk services include first level support services–personnel who act as a first point of contact for users requiring assistance. These skilled technicians, all working in Tampa, Florida, help resolve technical issues, which may include assistance with browsers, ISPs, Information Visibility Services interface questions, access to the data sources, normal installation of browsers and plug-ins, and most other difficulties faced by users. The first level support team is trained to provide assistance, diagnose problems, and propose solutions based on a step-by-step diagnostics process designed to resolve most problems. A diagnostics and escalation process is also implemented by LSI. Help desk service includes escalating problems to a second level of support when LSI has exhausted all first level support diagnostics.

LSI also provides second level support to acquire detailed diagnostics and solve complex problems with regard to LSI-controlled systems. Occasionally, resolution of a technical problem may require the coordination of the efforts of a number of service providers. In these cases, LSI maintains control of the communication with users during an outage or other critical event that requires a third party's participation to resolve. Live access to LSI's help desk client will always be available to clients while LSI facilitates the resolution of issues for Information Visibility Services users.

Features

Ease of Use

Link-Systems International regards the ease of use of its software as critically important.

Data correlation can be offered to every facet of your enterprise, including fiscal oversight, quality control, editorial capacities, and human resource management. Information Visibility Services is a middle tier technology allowing rapid inclusion of new data structures. Template-driven dashboards give ease of use with familiar controls, built-in alerts, and automated escalations of alerts.

The commitment of LSI to ease of use starts with end user functionality but includes all aspects of administrative and technical usage. Information Visibility Services has been successfully employed with a wide range of databases including MySQL, Oracle, DB2, and SQL Server, and can operate with either Windows or Unix operating systems. The user interface is completely Web based and does not require any third party downloads, plug-ins, or components.

Quantitatively Improved Outcomes

Quality assurance with continual analysis results in measurably better outcomes. Measurable areas of quality commonly sought in the setting of educational institutions and their business partners include:

- ¶ real-time data collection, analysis, and presentation
- ¶ proactive business process visibility
- ¶ contract compliance assurance
- ¶ pattern identification

Information Visibility Services addresses all of these items by providing a direct, visual presentation of each.

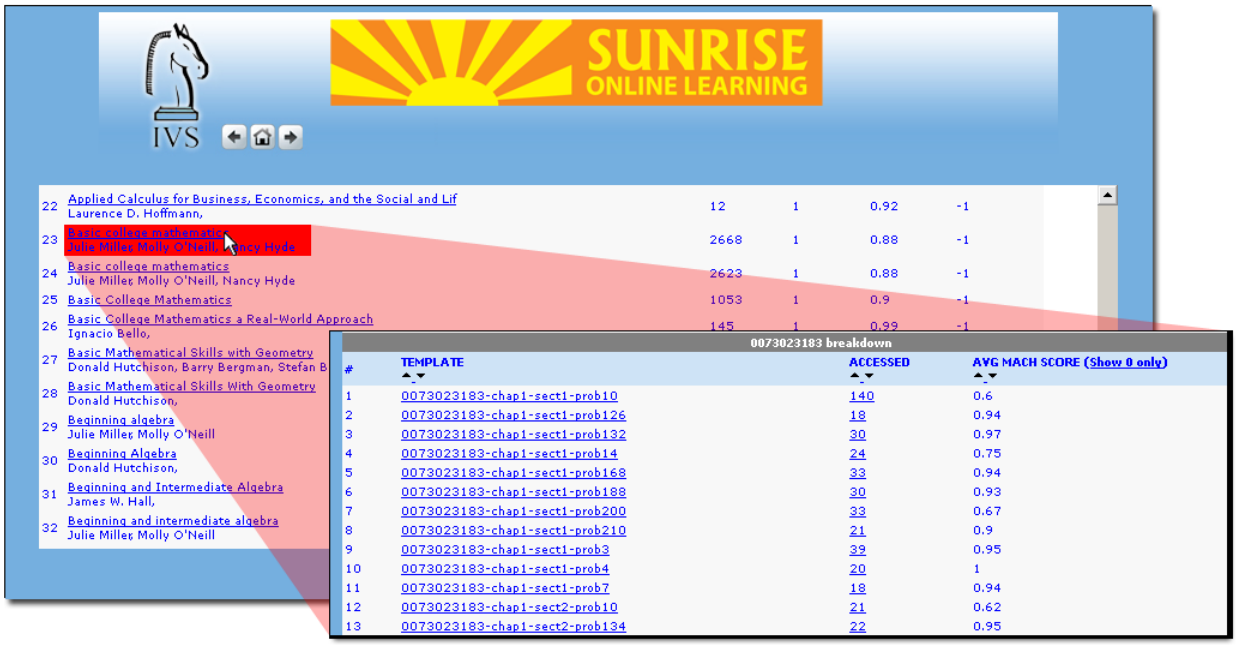

Figure 4. Detail with multi-level drill down

Dashboards with Drill Down

Information Visibility Services' dashboards measure the current status of critical business statistics. Specific rules are defined and dashboards display the level of achievement versus each standard for critical activities. Dashboards, along and a library of templates to facilitating rapid implementation, improve ease of use

Risk Management

Risk management seeks to analyze exposure and determine the best technique to limit risk exposure. Information Visibility Services identifies and assesses the exposure to risk and facilitates the prioritization of tasks that minimize risk.

Three techniques are presented in order to reduce exposure to risk:

1. Enforcing quality of data paths.
2. Immediate notification and persistent monitoring of self-defined objectives specific to each institution.
3. Refinement of pattern recognition to determine the early signals of risk compared to previous occurrences.

Information Visibility Services establishes a baseline to compare against for pattern recognition. That baseline works as a standard for poor and unsuccessful outcomes as well as successful patterns. Business activity is monitored to ensure improvement or detect poor or undesired outcomes. Real-time dashboards display high risk metrics for departments or staff performance, including financial factors. Personalized dashboards show customized metrics reflecting individual action plans. Alerts and immediate notifications inform staff of impending activity. Alerts escalate up the personnel hierarchy to ensure accountability.

Security

Education and business managers will not tolerate risk to data security. That is why Information Visibility Services can either be hosted on the institution's servers or utilize the tier four security host server provided by Link-Systems. According to standards described in *TIA-942: Data Center Standards Overview* published by the Uptime Institute, tier four is the highest level of data center reliability possible (Uptime Institute). Personnel are required to pass background checks. Biometric (fingerprint or retina scan) security is required for entry. These measures are reinforced by stringent standards for redundant and fault-tolerant infrastructure. All requirements for tier one, two, and three must also be met in addition to dual power sources for coolers, heating ventilation, and air-conditioning systems. There are no new data security risks introduced by utilizing Information Visibility Services.

Proactive Decisions

Each activity promotes a combination of data quality enforcement and business process workflow. Business process is made visible and augmented with quantitative figures so that business decision making is proactive instead of reactive, with a measurably improved outcome. Information Visibility Services enhances awareness of the essential details in the business process so that decision makers and stakeholders can utilize the results to generate high quality decisions quickly. The data-driven software is completely automated and provides a stream of condition-monitoring graphics and figures to produce a clear and relevant picture of the business situation.

Reports and dashboards are available for access, but there are also certain outputs that can be proactively delivered to users according to their needs. This includes notification delivery to mobile devices, such as phones or iPads, and remote computers. When criteria that are set previously are met, reports and notices can be automatically delivered to the end user. These alerts can take several forms, such as announcements upon log-in, SMS messages, or other convenient messages that notify the user to review the report.

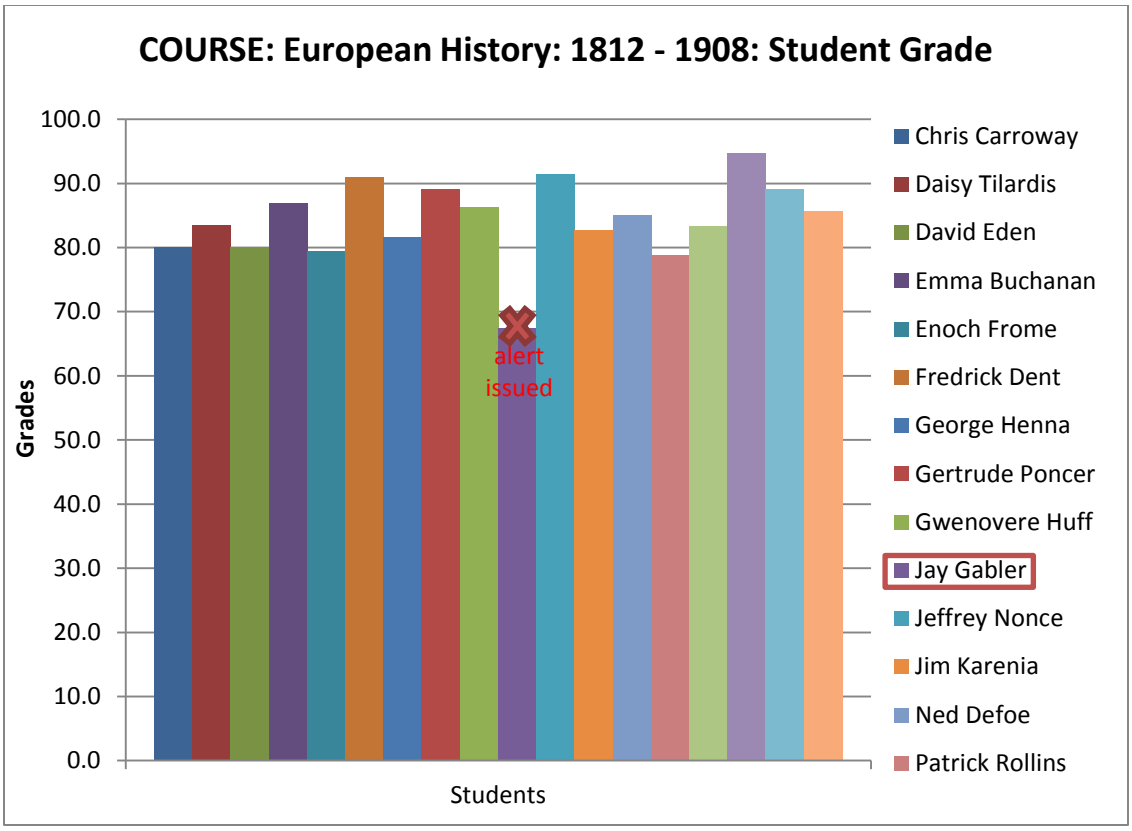

Figure 5. Increased Student Accountability via Alerts

Alerts / Escalations

Alerts are based on rules defined by the user and can be issued via three mechanisms:

1. Email
2. Text messaging (SMS)
3. Telephone voice messaging (including TTS for the deaf)

Notification preferences can be set per user. Notifications can be reminders with unlimited distribution lists, can be pre-configured, or can be dynamically generated.

Performance Management

Staff performance is the most significant driver of business development. Information Visibility Services provides the means to monitor staff performance in a continuous, strategic, and global manner. Current status and past and forecast progress can be monitored from easy-to-use dashboards, such as those shown in Figures 5 and 6.

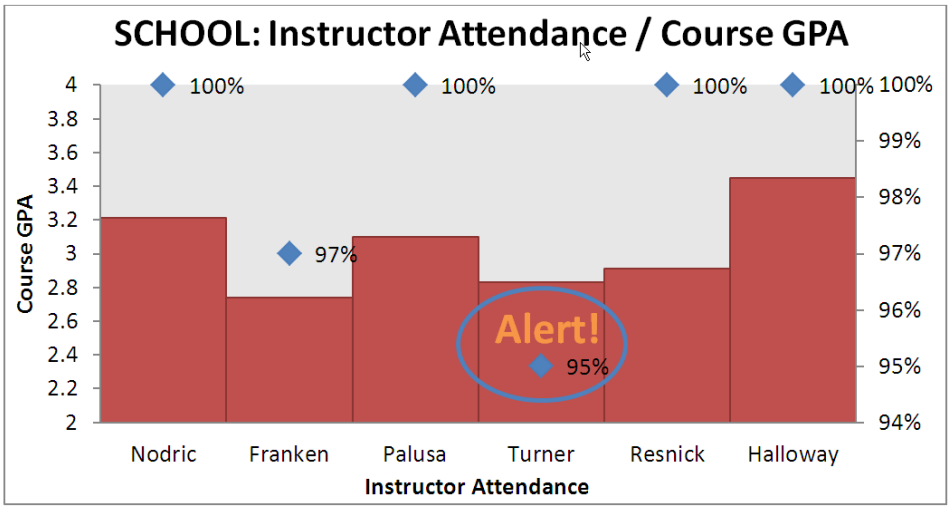

Figure 6. Increased Staff Accountability via Notifications

Reporting for each manager's staff can be summarized in a comprehensive manner with this staff performance report once clearly defined benchmarks and goals are set. Reports on staff might include the following:

Goal	The primary goal for this position
Owner	The person accountable for the goal
Measure	Statistic for measurement
Target value	The sought-after value
Initiatives	Actions intended to support the goal

Depending on the position under consideration, other areas of interest might be customer satisfaction, internal process, management growth, or financial progress. Tables 1-4 demonstrate the type of templates each of these reports might generate.

CUSTOMER				
Goal	**Measure**	**Target**	**Initiatives**	**Owner**
Increased Sales	$180,000	$225,000	Sales	Gibson

Table 1

INTERNAL PROCESS				
Goal	**Measure**	**Target**	**Initiatives**	**Owner**
Customer Satisf.	96%	100%	GSS	Kephart
Repeat Sales	$22,000	$45,000	Orion	Zirgen

Table 2

EMPLOYEE GROWTH				
Goal	**Measure**	**Target**	**Initiatives**	**Owner**
A+ Certification	Incomplete	Pass	Personal Growth	Kephart

Table 3

FINANCIAL PROCESS				
Goal	**Measure**	**Target**	**Initiatives**	**Owner**
Overhead Red.	$280,000	$500,000	Budget Austerity	Chapin

Table 4

These templates can easily be kept up to date as the specific goals, measures, and targets of the enterprise change over time. An example of such a set of templates in use is seen in Figure 7. Note in this report the display of different, interrelated aspects of employee performance, gathered transparently from multiple DBMS sources, and the application of user-selected criteria to the evaluation of performance.

TID	MEASURE	FREQUENCY	TARGET FOR 06/30/2010	LAST REPORT DATE	PREVIOUS PERFORMANCE	PROGRESS	CURRENT PERFORMANCE
LS09	QNTS Late Reporting	QTR	99.68%	2010-4-30	97.41%	↑	99.42%
LS10	QNTS Lead Generation Cost	MONTHLY	100%	2010-4-30	94.41%	↓	94.17%
LS11	QNTS Followthrough Rate	MONTHLY	10	2010-4-30	4.8	↑	4.4
LS24	QNTS Gains Vs Competition	YTD	44.6%	2010-4-30	45.56%	↑	46.19%
LS44	QNTS Bonus Qualification	YTD	74%	2010-4-30	78.14%	↔	78.14%
PL73	KSPL Bandwidth Avoidance	QTR	12%	2010-4-30	11.64%	↓	11.77%
PL18	KSPL Throughput	YTD	159	2010-4-30	169	↑	171
FF32	FF Uptime	QTR	84.27%	2010-4-30	95.03%	↑	95.46%
LW04	QA Request Fulfilment	MONTHLY	489	2010-4-30	411	↓	415

Figure 7. Example Personnel Performance Report

Summary

As reassuring as it is for decision makers in an academic or business environment to know that, in principle, the information they rely on for decision-making is “out there,” it leads to far better outcomes to have it in front of the appropriate stakeholders at the decisive moment. Information Visibility Services is the solution to the dilemma of maintaining technically incompatible DBMSs and multiple data-collection points as well as a proliferating set of legal guidelines to sharing information.

The features of Information Visibility Services, founded on its data-agnostic approach, grant the needed ability to correlate diverse data source. The service allows leaders of the enterprise to sample at one glimpse the interrelationships of operations, the risk and assurance issues, and make rapid assessment and awareness of key metrics.

Institutions can benefit from the use of Information Visibility Services by getting better value from sunk information technology costs and tightening accountability for all levels of stakeholders. Enterprises, especially educational institutions and their corporate partners, can exploit data to its utmost, avoid the common pitfalls of doing so, and capitalize on time-sensitive opportunities.

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About Link-Systems International, Inc.

LSI Mission Statement

Link-Systems International is the leader in providing integrated technology and service solutions to educators in order to improve the quality of education and training, ensure student success and retention, and provide affordable education to students, workers, and their families.

Research-Based Approach

Link-Systems International (LSI) employs Integrated Cognitive-Contextualized Learning (ICCL) in order to deliver research-proven online learning products and services that are based on the latest developments in learning theory. Educators work hard to engage students and to help them reach their learning goals; we offer theory and practice to supply educational technology in support of that work. LSI has recognized the unity of two important arms of constructivist learning theory—the measurement of self-achieved cognitive advances against agreed-upon standards and the contextualization of learning to create learning initiatives for the active learner.

Over the years, LSI has accumulated a wealth of experience with educators seeking to engage their students through authentic and involving learning experiences. At the same time, institutions and innovators sought new ways to measure and reinforce concrete cognitive advances. According to ICCL, these are simply two sides of the same experience: implementation of online learning tools enables both the delivery of contextualized content and the verification of learning achievement.

The application of ICCL has practical results for LSI, whose products and services are all based on the theory. LSI uses ICCL to customize its products and services to meet the specific needs of its learning institutions and their partners. At the same time, all of its products and services make educational achievement measurable to ensure learning success while peer-reviewed research supports their effectiveness. The partnerships between educators and LSI are helping to define the new face of quality learning in the digital age.

Our Company

LSI is a privately-held company that has been dedicated to student success and student retention in K-12 education, higher education, and workforce development education since 1995. We specialize in technology development, online tutoring services, and content services.

Our core technologies include a flexible online tutoring/teaching platform, an online grade book, an online algorithm engine with metadata and workflow capabilities, and an online business intelligence/data mining technology designed to provide real-time alerts regarding student/school/teacher performance, student attendance, and other metrics.

Our core services include content development, consulting, and online tutoring through our NetTutor® brand.

Our customers include K-12 publishers, higher education publishers, virtual high schools, higher education institutions, technology companies, and joint programs dedicated to providing online educational content to members of organized labor and their families.

We are located in Tampa, Florida, a few miles from the University of South Florida, which has excellent engineering, computer science and mathematics programs, providing LSI many of its employees.

Launched in 1995, LSI has created several unique and powerful technologies, which facilitate the sharing of content over the Internet. We specialize in mathematics, technical and scientific content, the most critical types of online content with respect to student success, and the most difficult to share online.

Student Success and Student Retention

Today, LSI is recognized by a variety of publishers and educational institutions not only for its high-quality work and dedication to meeting commitments, but also for its unique ability to develop digital strategies that are tailored to the needs of its customers.

Our partners and customers have come to value and trust LSI because we are the only company that offers a complete suite of interoperable solutions that address the entire life cycle of the student, with an overt focus on the bottom line: student success and student retention. That student life cycle includes:

* Online Assessment and Placement
* Content Authoring
* Content Recovery, Content Management and Metadata Management
* Online Teaching, Collaboration, and Tutoring
* Online Homework and Testing
* Online Grade book Technologies
* Online Real-Time Performance Monitoring and Intervention

Through a relationship with LSI, educators acquire the ability to construct a holistic approach to student success and student retention.

Corporate Executive Team

Vincent T. Forese, President, Chief Executive Officer
William K. Barter, Senior Vice President, Sales, Marketing, and Business Development
Dr. Emil Moskona, Senior Vice President, Chief Operating Officer
Dr. Yanmu Zhou, Senior Vice President, Chief Technology Officer
Dr. Milena Moskova, Vice President, Research and Development

About Academic Research at LSI

We are enthusiastic about the commitment of institutions and academics to the use of technology with proven benefits to their students. If you would like to write about the impact of Web-based technology, please let us know. We encourage educational research and will work with you and your staff to develop scientific studies into the relationship of the online learning experience to successful student outcomes. Please contact our Academic Research Department.

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