

The Optimal Reference Guide:

D3M Framework

Building a Longitudinal Data System

Extraordinary insight™ into today's education information topics

With a Foreword by Glynn D. Ligon, Ph.D.



ESP Solutions Group

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Foreword

By Glynn D. Ligon, Ph.D.

Data-driven decision making is the focus of all we do here at ESP Solutions Group. Our quest is to provide extraordinary insights into how to manage data to support decision making. That's a very large task. In fact, we have recently updated all our thinking and writing about the information systems required to support data-driven decision making. This is partially in response to the growing interest and demands by education agencies to build longitudinal information systems that provide quality data to decision makers. Moreover, this is to keep us and our clients up-to-speed on the ever-changing landscape of education information systems.

ESP's pictures have become known for capturing the essence of an issue and representing the relationships of the people and systems that provide a solution. The first was commissioned by Secretary of Education Rod Paige to describe the technology requirements for a state to meet the No Child Left Behind Act's mandates. Our **"Secretary to Secretary"** diagram (S2S) may be our best known, and our **"D3M Framework"** has become the foundation for the enterprise solutions we have crafted with our clients. S2S remains current as a high-level perspective on the interoperability of all our information systems from the school to the U.S. Office of Education. However, time has come for a new D3M Framework view.

What's changed? The major changes come from the many education agency clients we have collaborated with on the D3M Framework. Some of the original components are now simply details within larger components. The student identifier is one. Every state has identifiers; they are now a consensus data element. As such, we no longer need to promote their adoption and showcase them beyond their actual significance. We merely need to use them to link records across data stores and processes. Another change is the reinvention of the concept of the data warehouse. "Data warehouse" is no longer a single-application component, but is rather a set of data stores, each with a focused data function. The "all eggs in one basket" data warehouse simply became a "too little too late" data store to satisfy the on-demand nature of the reporting education agencies are requiring now.

So, we have redefined the criteria for the modern education agency information system.

- Agile (extensible, expandable, interoperable)
- Standards Based (USED, SIF, state metadata, local metadata, PESC)
- Action Oriented (action reports, alerts)
- Efficient (web-based collection, extensible storage, on-demand access)
- Policy Compliant (FERPA, acceptable use, open records)
- Affordable (build/buy, annual maintenance)

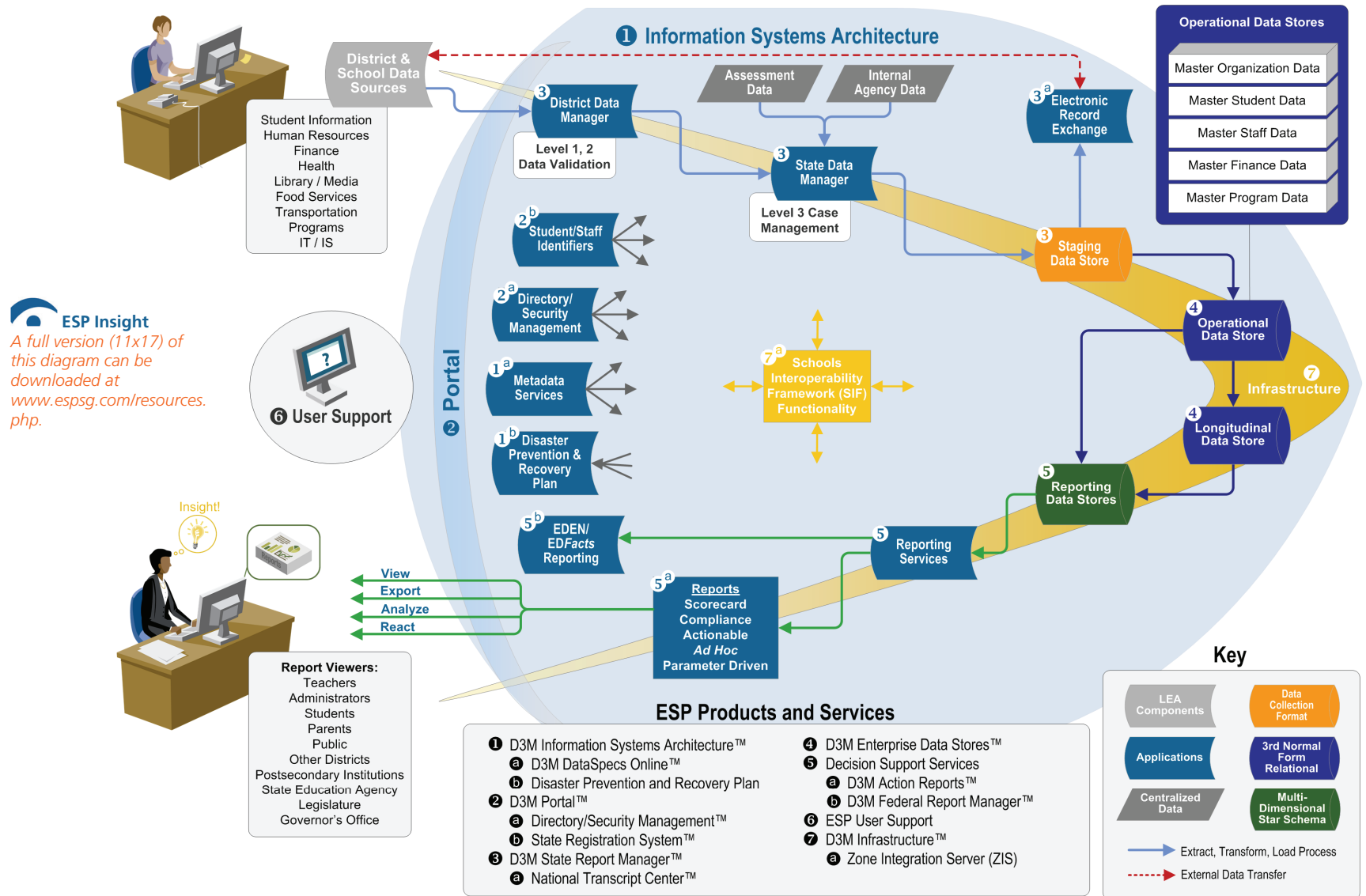
Our experience is that each education agency is at its own level of implementation, e.g., legacy applications ready for replacement or upgrade, non-existent applications, etc. Therefore, a true solution must allow each agency to pursue only

the changes needed without the burden of a full-scale makeover. Of course, such a dramatic total retooling is also an alternative.

The D3M Framework works. With the support of Microsoft, the D3M Alliance has demonstrated interoperability among 18 applications from five vendors. SIF interoperability standards are beginning to manage data exchanges in real time for the real world. However, the ultimate goal is not merely to create a marvelous technology infrastructure, but to establish a framework that collects max-yield data (those data that everyone agrees are worth the effort required to collect, clean, and report them) and provides them to decision makers in the form and at the time they need them.

This Optimal Reference Guide (ORG) describes today's D3M Framework.

Figure 1: D3M Framework



ESP Insight
 A full version (11x17) of this diagram can be downloaded at www.espsg.com/resources.php.

Introduction

The D3M Framework is a high-level picture that immediately makes clear how education data move into the view of someone when a decision must be made. Our vision is simple.

When students and the adults who support them reach a decision point, all the information they need to make the right choice will be at their fingertips. When education agencies and schools need to know how to accomplish this data-driven decision making, they turn to ESP Solutions Group because we are the ones with the **extraordinary insight** into how to make it happen.

All our information systems will be integrated to share data embracing open standards. Confidentiality, security, integrity, validity, quality, and timeliness will characterize this sharing process. Technology and the creative architecture that takes advantage of it will leverage open standards that allow a single “information network” to evolve.

Submitting reports will be replaced by using reports. Assessment, accountability, and accounting will be unobtrusive processes performed by the information network using the transactional applications that make individuals productive.

Educators will educate, not stop educating to collect, report, and analyze data. Students will learn, not stop learning to take assessments.

The people of ESP Solutions Group will be significant contributors to the realization of this vision.

We developed the D3M Framework (see Figure 1) to guide our clients and us as we work together to make this vision a reality.



Building an Enterprise Education Information System

If an education agency were to start from scratch building a comprehensive information system, what are the steps they need to follow? Even though every education agency is somewhere along that path already, this is an excellent benchmark exercise to begin a review of an agency's status.

Other than beginning with Step 1 (document the information systems architecture), all the other steps are more concurrent than they are sequential. For example, Step 7 is building the infrastructure. Clearly Step 7 is far along in most education agencies, e.g., networks, hardware, and support staff are in place. However, each enhancement to the other components creates a new demand for enhancements in the infrastructure. The key to success is not to let any one step get out ahead of the others too far. For example, if the data-driven decision support system is built and launched before data are collected and stored for use and before a portal is available to manage user activity, the user community's frustration could create a dysfunctional backlash. On the other hand, if the decision support tools and some data are not available to the users relatively early in the process, the burden and expense of building the other components may not be appreciated enough to sustain momentum and support for the system. Again, Step 1, the Information System Architecture, is needed to guide all procurement and development, and to provide a common vision and foundation for all other activity.

Another reality about these steps is that none of them is ever completed. These are on-going activities that must keep pace with the ever-changing technologies and shifting agency demands.

Step 1: Document the information systems architecture.

Step 2: Establish enterprise identity management, access, and collaboration services.

Step 3: Collect, validate, and certify data in source systems.

Step 4: Manage operational and longitudinal data stores.

Step 5: Implement reporting tools to inform decision makers.

Step 6: Provide user support and training.

Step 7: Enhance infrastructure and interoperability.

These seven steps follow the main components of the D3M Framework (see Figure 2).

Figure 2: D3M Framework Components

Description	Sample Contents
<p>Information Systems Architecture—the metadata, hardware, software, and network standards, policies, governance, and requirements by which all technology systems are built and managed</p>	<ul style="list-style-type: none"> • Metadata Architecture, Standards, Business Rules • Systems Interoperability Standards • Policy, Governance, Stakeholder Guidance • Standards and Procedures that Guide All Other Components • Business Continuation and Disaster Prevention and Recovery Planning
<p>Portal—the system that authenticates and authorizes all users to provide appropriate access and security to all information</p>	<ul style="list-style-type: none"> • Directory Services with Security for Authentication and Authorization • Individual Identifier and Locator System (Students, Teachers, All Others) • Collaboration Tools • Document and Resource Management • Notifications
<p>Collections—the mechanisms for gathering and consolidating data</p>	<ul style="list-style-type: none"> • Data Specifications (Content), Business Rules, Periodicities • Data Quality, Certification of Submissions • Edit Reports and Help • Extensive Content about Students, Educators, Schools, Programs, etc.
<p>Data Stores—the centralized locations where data are stored, managed, and accessed according to a comprehensive data model</p>	<ul style="list-style-type: none"> • Transactional • Staging • Operational • Longitudinal • Reporting • Back-Up
<p>Data-Driven Decision Support System—the way the data are provided to users for decision making, e.g., reports, queries, data files, etc.</p>	<ul style="list-style-type: none"> • Action Reports, Standard Reports • Drill-Down Action Reports • <i>Ad Hoc</i> Query • Statistical Analysis (Research and Evaluation) • Profiles and Accountability Report Cards • Data Extracts
<p>User Support—the system that trains, helps, and guides users to ensure efficient and proper use of the information</p>	<ul style="list-style-type: none"> • Help and Support • Training and Professional Development • User Advisory Groups

Description	Sample Contents
Infrastructure —the physical hardware, software, network, and human resources required to support the technology systems and provide interoperability for data sharing	<ul style="list-style-type: none"> • Interoperability • Hardware • Systems Software • Application Software • Personal Productivity Software • LAN, WAN, and Internet Connectivity • Financial Underwriting • Human Resources

Longitudinal Data System or Enterprise Education Information System?

The term longitudinal data system was made compelling by the Institute of Education Sciences (IES) and the National Center for Education Statistics (NCES) when they began awarding multi-million dollar grants to states. We have used the term enterprise education information system for years because it more broadly represents both the scope and the uses for information and the data-driven decision making that information supports. So either term is appropriate to use for the D3M Framework.

Implementation Phases

As a new or upgraded enterprise education information system is implemented, there are at least three major phases that will be completed: the pre-implementation phase, the implementation phase, and the maintenance phase.

The following process is recommended for management of the enhanced system. The process as described is worded for a state education agency (SEA). A local education agency (LEA) would use the appropriate steps and levels of stakeholders.

A. Pre-Implementation Phase: Planning, Design, Funding, Political Buy-In

1. Create a Standards and Policy Advisory Group to meet periodically to review policy issues and standards, and to make recommendations to the agency for adoption or submission to the governance/legislative process as appropriate. This group should include broad representation of high-level people with policy expertise, e.g., representatives from the districts, schools, the Legislature, the SEA, professional educator association(s), and other agencies.
2. Create a Technical Advisory Group to meet as needed to review and make recommendations for implementation issues, such as timelines, priorities, targeted assistance to trailing districts, coordination of vendors or consortia, and compliance with policies and standards. The members need to have a practical understanding of how schools and districts conduct their business. This group should create subgroups as needed to resolve specific issues and make recommendations to the group.
3. Create an internal agency Coordination Team to meet monthly to ensure that current collections and other activities are phased into the system smoothly and to ensure that all appropriate information needs are met by

the agency. Both technical and special program staff should be represented.

4. Hire required staff or contractors. Create a web site resource for accessing all documents, references, communications, and schedules. If an enterprise portal already exists, it will provide this functionality.
5. Manage the process for policy/legislative action, issuance of requests for proposals, selection of vendors, and communications with stakeholders.
6. Create the final design and specifications with the contracted vendor. Finalize business rules for data validation. Establish the reporting/submission timeline.
7. Participate in Schools Interoperability Framework Association (SIFA) (and other standards) meetings and partner with other districts or states to create new or enhanced state-reporting objects.
8. Finalize individual school and district plans based upon budget and timelines adopted. (Create consortia as desired based upon technical services and shared software applications. Support user groups for districts with the same software applications.)

B. Implementation Phase

1. Establish an oversight consultant or manager to monitor the technical aspects of final design and implementation.
2. Convene the Technical Advisory Group as needed to review and make recommendations for implementation issues, such as timelines, priorities, and compliance with policies and standards.
3. Convene the Coordination Team to ensure that current collections are phased into the system smoothly and to ensure that all appropriate information needs are met by the agency.
4. Manage the processes for implementation and communications with stakeholders.
5. Participate in SIFA (and other standards) meetings to ensure adopted objects meet the districts' and state's needs.
6. Establish and conduct early adopter and pilot implementations.
7. Transition from web reports to the new submissions as the contractor delivers the system components.
8. Evaluate the success of early implementation across schools and districts to make modifications for on-going processes.

C. Maintenance Phase

1. Manage on-going contracts, system updates, and needs for upgrades across district software applications.
2. Participate in SIFA (and other standards) meetings to ensure adopted objects meet the districts' and state's needs.
3. Update individual school and district plans to monitor progress.
4. Continue the active involvement of the advisory groups.

These processes are based upon a review of best practices across states for managing their state-level information systems. Regardless of the model and standards adopted within each district or state, these are over-riding procedures that have been associated with success.

Steps for Building a Longitudinal Data System

These steps are based upon a review of best practices across states for managing their state-level information systems. Regardless of the model and standards adopted within each district or state, these are over-riding procedures that have been associated with success.

Step 1: Document the Information Systems Architecture

Description: Information Systems Architecture (ISA) encompasses the metadata, hardware, software, and network standards, policies, governance, and requirements by which all information technology systems are developed, deployed, and managed. The entire D3M Framework is guided by this architecture. Whenever a decision is made about the information ecosystem, the information systems architecture document provides the standards and practices by which the decision is made.

The ISA is a hybrid technical and policy guide. The ISA does not need to contain all the details of an agency's hardware, software, and network architecture, but it should establish the standards to which those detailed requirements, specifications, and documentation must be held.

Requirements: A functional ISA requires documentation of existing standards, policies, procedures, and systems. The outline below provides a high-level view of the contents of a comprehensive, enterprise-level information systems architecture document. As is evident from these components, this document requires the participation and buy-in of the full range of people in an education agency—and its “clients.”

- Agency Organizational Structure
 - Oversight
 - Management
 - Staff Resources
 - Budget
 - Practices, Mandates, Policies, Laws
 - Project Management Methodology
- Metadata Standards
 - Data Dictionary
 - Data Model
 - Validation Rules
 - Transformation Rules
 - Access Rules
- Project Management
 - Methodology
 - Risk Management
 - Change Management

- Infrastructure Requirements and Standards
 - Hardware
 - Network
 - Software
 - Personnel
- Disaster Prevention and Recovery
 - Key System Documentation
 - System Availability and Capacity
 - Key System Backup
 - Key System Recovery
 - Business Continuation Plan
- Portal Services
 - Confidentiality and Security Management
 - Access and Directory Services
 - Presentation Services
 - Collaboration Support
 - Identity Management (Individual Identifiers)
- Data Management and Documentation
 - Data Flow Diagram
 - Data Validation Documentation
 - Data Transformation Documentation
 - Interoperability Standards
 - Platforms, Tool Sets
 - Application Review and Adoption
- Data Stores
 - Transactional
 - Staging
 - Operational
 - Longitudinal
 - Reporting
 - Back-Up
- Data-Driven Decision Support
 - Decision Resources
 - Accountability Reports (Profiles/Scorecard/Report Card)
 - Statistical Reports
 - Compliance Reports
 - Analysis and *Ad Hoc* Reports
 - Audit Reports
- User Support
 - Buy-In, Engagement
 - Training and User Documentation
 - Three Tier Help and Support

ESP has worked with SEAs and LEAs on complete and partial information systems architecture projects. Agencies often have a priority need for a portion of the architecture to be formalized, but knowing the full scope is always useful context.

ESP's Solution: ESP has standardized, detailed "Oversight Questions" and "Benchmarks" for each architecture entry in the outline above. Our process for

development of an ISA is to interview key personnel within the agency to document current practices and policies. A draft architecture document is created with all the gaps identified. ESP's engagement extends as far as the agency desires, then the document is provided in the preferred electronic format so the agency can continue to enhance it and keep it current over time.

ESP Products and Service Offerings:

- 1. D3M Information Systems Architecture (ISA)TM
- 1a. DataSpecs OnlineTM
 - Data Inventory
 - Data Dictionary
 - CourseWalkTM
 - ED*Facts* Crosswalk
 - SIF State Profile Crosswalk
 - NCES Data Handbooks Crosswalk
 - Transcript Crosswalk
- 1b. Disaster Prevention and Recovery Plan (includes business continuation plan)

Step 2: Establish Enterprise Identity Management, Access, and Collaboration Services

Description: Identity management refers to the system components that manage and provide access to authoritative information about the individuals and organizations that make up the enterprise. For state education agencies, the enterprise includes all of the students, educators, and stakeholders who are members of schools, districts, the SEA, and related organizations. Identity management encompasses the directory, security, and personalized presentation framework. Collaboration services are the emerging need within education enterprises to share information, ideas, and resources.

Requirements: An education agency has a special obligation to protect the confidential information of individuals. The proliferation of reporting tools and reports with breakouts of subgroups increases the requirement for authenticating and authorizing users of data and applications. A single sign-on portal has emerged as the most comprehensive and practical solution. In addition, a portal provides the collaboration tools demanded by the ever-increasing interdependence of teachers and administrators on each others' resources and insights. Several of the key components and examples of their functions are:

Enterprise Directory

- a. Maintain an authoritative hierarchy of organizations (school-district-region-state).
- b. Maintain a 3rd normal relational representation of organizations, attributes, and relationships among organizations.
- c. Maintain a single, authoritative record for every user of a system and key individuals (e.g., building principal).

- d. Enable users to maintain more than one role within and between organizations.
- e. Enable individuals to maintain their contact information and other attributes.
- f. Enable delegated organization-role authorization.

Enterprise Security

- a. Provide single sign-on user name/password authentication as a service to all subscribing applications.
- b. Provide user-organization-role relationships as a service to all subscribing applications.

Enterprise Portal

- a. Provide navigation between applications.
- b. Provide a frame for applications to publish webparts.
- c. Enable users to personalize their portal.

State ID Assignment

- a. Enable student and staff records to be entered individually, in batch files, and/or through SIF automation.
- b. Assign unique, consistent identifiers to each student and staff member.
- c. Match new records with existing records phonetically, with nick names, abbreviations, etc. to identify cases that may be the same individual for human resolution.

ESP's Solution: ESP has deployed more statewide, open-enterprise education portals than any other company. Our D3M portal technology is built on Microsoft's SharePoint 2007 platform. We have customized SharePoint to be optimized for state education agencies and built webparts to enable distributed directory administration and state identifier assignment.

ESP Products and Service Offerings:

- 2. D3M Portal™
- 2a. Directory/Security Management™
- 2b. State Registration System™

Step 3: Collect, Validate, and Certify Data in Source Systems

Description: Collections are the mechanisms for gathering data. A significant portion of the landscape in the D3M Framework diagram is devoted to collection mechanisms and processes. These collection processes are at the core of data quality—delivering timely, complete, and accurate data. ESP has emphasized in all our client engagements an appreciation for data-driven decision making, which is predicated upon the availability of quality data at the time decisions are made. Our understanding of data quality emphasizes the risk whenever data are exchanged. The design of intelligent collection processes and applications ensures that the provider of data is responsible for quality rather than delegating that task upward to persons with less insight into the quality of the data.

Requirements: The key to data quality is source system validation and correction. SEA data collection systems must provide near immediate validation reports to district data managers to enable them to correct data at the source. It does little good to correct data errors at the SEA level if the same errors will be reported next cycle.

The components of the collection process are described below with examples of their functionality.

Data Collection Modules

- Student Enrollment
 - October 1 Official Enrollment Count
 - Assessment Pre-Code
 - End-of-Year Report
 - Drop-Out Accounting
- Staff
 - Highly Qualified Staff
- Discipline Incidents
- Class Rosters
- Program Participation
 - Special Education
 - Career Technical Education
 - Title 1
 - English Language Learners
 - Many Others
- Post-Graduation Activities
- Local Assessments and Benchmarks
- School/District Summary Data

Data Validation

- Level 1 Rules – Field and File
- Level 2 Rules – Complex File Rules, References to External Systems
- Level 3 Rules – Multi-File Rules (e.g., Duplicate Enrollment across Districts)

ESP's Solution: ESP's flagship product, State Report Manager™ is the only product in the market built exclusively for SEA data collection and validation. In the fast-growing field of electronic student record and transcript exchange, the National Transcript Center leads the way with enabling exchanges of records with translations among all the major national standards (e.g., PESC, EDI/SPEEDE, SIF) and individual state standards (e.g., Texas TReX, Wyoming, West Virginia, Virginia, Colorado, etc.)

ESP Products and Service Offerings:

- 3. D3M State Report Manger (SRM)™
- 3a. National Transcript Center (NTC)™

Step 4: Manage Operational and Longitudinal Data Stores

Description: Data Stores are the centralized locations where data are located, managed, and accessed. The data stores must be configured in alignment with the organization's comprehensive data model.

The term data warehouse gained popularity in the late 90's and early 20th century with the promise of a single repository for all important data and a single mechanism for reporting the data. "Data warehouse" is no longer a single-application component, but is rather a set of data stores, each with a focused data function. The "all eggs in one basket" data warehouse simply became a "too little too late" data store to satisfy the on-demand nature of the reporting education agencies are requiring now.

Differentiated-function data stores can be categorized as follows:

- Transactional
- Staging
- Operational
- Longitudinal
- Reporting
- Back-Up

Requirements: The key distinction needed is the declaration of certain data stores as "authoritative." Too often SEAs move data between repositories, transforming and aggregating as they go. In this process, they often lose track of which repository is the authority. An SEA should, at a minimum, designate the following authoritative data stores:

Operational Data Store

- Assessment
- Student
- Staff
- Organization
- Finance
- Project (e.g., special education, meals, career, English language learners, Title 1, etc.)

Longitudinal Data Store

Reporting Data Store(s)

Back-Up Data Store

ESP's Solution: Data stores have become commodities for organizations. The brand names do not matter much anymore. The key to success is the data model that is designed and configured to match the requirements of the agency. Our return on investment analysis determined that the Microsoft suite including SQL Server has established itself as the most affordable in initial purchase, configuration, and maintenance.

ESP Products and Service Offerings:

- 4. D3M Enterprise Data Stores™
 - Operational Data Store
 - Longitudinal Data Store
 - Reporting Data Store

Step 5: Implement Reporting Tools to Inform Decision Makers

Description: Data-Driven Decision Making (D3M) refers to systems that provide data to users for consideration when a decision is pending, e.g., reports, queries, data files, etc. Agencies have available numerous reporting tool sets. Some are already configured; others must be configured almost totally by the education agency.

We have described the types of reporting that a decision support system must satisfy in two earlier Optimal Reference Guides:

- Action Speak Louder than Data
- From Information to Insight – The Point of Indicators

Requirements: SEAs have an affirmative obligation to re-purpose and supplement data collected initially for compliance to support teachers and administrators in using those data for data-driven decision making (D3M). The key to successfully accomplishing this goal is the transformation of indelible data into statistically valid and educationally relevant information. Typically, this requires some degree of controlled aggregation and/or transformation. When the resulting data are calculated into a valid metric, they can be called statistics. When they are educationally relevant, they can be called key performance indicators (KPI). When KPIs from multiple domains are summarized in a single report, a balanced score card is created. Below are some samples of reports.

School/District Summary Reports

- Balanced Scorecard
- Profile
- NCLB Report Card

Statistical Reports with Drill-Down Capacity

- Enrollment
- Assessment
- Academic Growth
- Attendance
- Discipline
- Dropout Tracking
- Graduation and Follow-Up
- Staff
- Finance

Ad Hoc Reporting

EDFacts

 **ESP Insight**
*Optimal Reference Guides
can be downloaded at
[www.espsg.com/resources.
php](http://www.espsg.com/resources.php).*

ESP's Solution: ESP's core expertise comes into focus with reporting. Whereas other companies also have engineering talent and products, ESP focuses on leveraging partner talent to create for education agencies complete solutions that focus on:

- Data Quality
- Statistical Validity
- Educational Relevance
- Data Visualization

EDFacts (formerly known as EDEN, PBDMI, or EDICS depending on long-term memory) is the U.S. Department of Education's system for collecting data from states. ESP provided design and data standards support for EDFacts before turning to helping individual states meet the new requirements.

ESP Products and Service Offerings:

- 5. Decision Support Services
- 5a. D3M Action Reports™
- 5b. D3M Federal Report Manager™

Step 6: Provide User Support and Training

Description: Google doesn't provide professional development. Properly designed applications require minimal formal training to use. The challenge for education agencies is more formidable. They must work with districts to change behavior. Data quality and data-driven decision making requires some fundamental changes to the human processes of the people who interact with the information systems. Whether the state's objective is to roll out solely to local data managers to collect data, or the agency has more ambitious goals to roll out a decision support and collaboration environment to every teacher in the state, the users of these information systems need support to change the culture as well as the processes in ways that work.

User support denotes the system that trains, helps, and guides users to ensure efficient and proper use of the information.

- Help and Support
- Training and Professional Development
- User Advisory Groups

Requirements: Well-designed and functional information systems that are helpful may eventually be adopted by a significant portion of the target user base. For more, state leadership is essential. An official mandate is typically required to ensure adoption by all potential users. State-sponsored support should address the following areas:

Stakeholder Advisory Groups

HelpDesk

- Level 1: Log all calls, resolve 50%, escalate, create reports,

- Level 2: Data oriented and technical issue resolution.
- Level 3: Developer bug fixes

User Documentation

Training

- Traditional Group Sessions
- Distance Learning Delivery
- Recorded Sessions
- On-Site Intervention and Support

ESP's Solution: ESP typically partners with local companies that have talented professionals on the ground in the client's state.

ESP Products and Service Offerings:

- 6. ESP User Support

Step 7: Enhance Infrastructure and Interoperability

Description: Hardware, software, and network components must be compatible, mutually supportive, and managed by adequately trained and experienced staff. Education agencies are not starting from scratch to build their technology infrastructure. The legacy systems must be managed successfully until they are enhanced or replaced. In the modern enterprise education information system, all the infrastructure components must be:

- Agile (extensible, expandable, interoperable)
- Standards Based (USED, SIF, state metadata, local metadata)
- Action Oriented (action reports, alerts)
- Efficient (collection, storage, access)
- Policy Compliant (FERPA, acceptable use, open records)
- Affordable (build/buy, annual maintenance)

Managing the sharing of data among the various applications and data stores within the agency—and across agencies—is a major challenge. Without forgetting the physical hardware, network, and facility requirements, interoperability is where ESP has focused our attention. The Schools Interoperability Framework is the 10-year-old, yet still developing national standard for PK-12 data exchange. SIF is fully supported by the USED, a majority of states, and (increasingly) the vendor community. No other education data standard comes close to this level of support. A system cannot accurately claim to be completely open standards compliant without building SIF into its design. With that said, three important caveats are:

- **SIF is still a relatively immature specification.** Under the best of conditions, SIF still only provides approximately 60% of the integration solution, i.e., 40% of the effort is still needed to configure and integrate the SIF components (e.g., ZIS, agents). SIF is not yet “plug and play.”

- **SIF is a networked application.** As such, any failure or lack of proper configuration at any point in the process will result in the experience of the system “failing.” Problems arising from any component part can be intermittent and difficult to diagnose and fully resolve. Certifying that the installation is working end-to-end is no guarantee that it will continue to work flawlessly end-to-end. Ongoing administration is required.
- **Not every district is ready for SIF at the same time.** Because of the first two bullets, it is essential that states plan on district adoption in stages and provide extra time and support for the districts with the lowest IT capacity. Sometimes this is the small district with no dedicated staff. Sometimes this is the large districts with complex systems that the staff is not easily able to support.

Requirements: The long-term human costs of managing data that will remain in “stovepipe” systems create a compelling case for schools, districts, and states to embrace SIF. Examples of both vertical and horizontal SIF-enabled processes are:

Vertical Reporting District to State

- State personal identifier assignment
- Student enrollment event and course roster collections
- LEA to SEA data collections

Horizontal Deployments within Districts

- SIS (student information system) student core update with food services, transportation, library/media services, and other transactional systems
- SIS, assessment, library fines, textbook assignment, and discipline record update with electronic transcript exchange

ESP’s Solution: ESP has partnered with Edustructures to support statewide SIF initiatives in more states than any other team. Our two companies’ technical professionals and teams serve on the SIFA Board and head the Technical Board, while leading significant internal SIFA committees.

ESP Products and Service Offerings:

- 7. D3M Infrastructure™
 - Schools Interoperability Framework
 - SIF State Profiles
 - Edustructures’ SIFWorks™, Zone Integration Server™ (ZIS)
 - Edustructures’ Student Locator Framework™ (SLF)
 - Edustructures’ Vertical Reporting Framework™ (VRF)
 - ESP’s SIF Agent Selection, Deployment, and Configuration Services

Conclusion

A year ago, during the NCES MIS Conference, the D3M Alliance conducted a demonstration of 18 applications from five companies running in a single environment, sharing data using SIF standards. The demo was about as long as the drive from the conference hotel to Microsoft's Atlanta Headquarters. In the same time that it took to move about 100 people through rush hour traffic, the D3M Alliance enrolled a student, assigned an identifier, requested and received an official record from the student's sending school, shared the student's basic information with all the registered applications, created a profile of the student's data, generated group reports using the full student database, sent data from the school to the district to the state, and managed communications across all the people now responsible for the student.

Things have improved since then. Yes, this interactive, interoperable environment is even more efficient and capable now than a year ago. What this paper does is provide the picture of how all the moving parts fit together. Is it the final? No. We'll continue to update the components, redraw the relationships, and reflect the latest in the technology upon which we have grown so dependent.



Attachment: Sample Information Systems Architecture Benchmarks for Best Practices

Excerpt from ESP's Optimal Reference Guide: "Management of an Education Information System."

Characteristic: 2. Management

What staff and responsibilities are necessary?

This benchmark links to Longitudinal Data Systems Requirements and No Child Left Behind.

Question 2.1: Who or what office has primary responsibility for the management of data within the SEA?

Benchmark 2.1.1: A designated person or office has the responsibility for the management (or delegation of the management) of all data. A single point of contact is designated for all issues related to data management.

The status for the SEA as of 05/13/08 is:

IT has the primary responsibility within the SEA for management of data. The SEA Data Management Council provides oversight and approval for data management activities.

Next Steps:

1. Continue the communications between IT and the SEA Data Management Council with periodic updates and other data activities.
2. Develop a communications plan for providing access to all IT users to documents, requirements, and help to ensure that everyone knows how to seek approval for all data collections and data management initiatives.

Question 2.2: What qualifications should the management staff have?

Benchmark 2.2.1: Management staff are trained and experienced in data management, technology, administration, and public education.

The status for the SEA as of 05/13/08 is:

IT has job descriptions for positions responsible for data management and the information systems within the SEA. Staff members participate in an annual performance review.

Next Steps:

1. Positions and their related job descriptions will be periodically reviewed within the context of the changes implemented for IT.

2. Job descriptions will be updated as appropriate to describe requirements for training and experience.
3. Persons hired will meet the adopted requirements.

Question 2.3: What organization plan provides the best use and supervision of data management staff?

Benchmark 2.3.1: The organizational plan provides data management staff with the technical supervision required while maintaining a close working relationship with the authoritative data sources.

The status for the SEA as of 05/13/08 is:

The SEA Data Management Council provides the organization that facilitates communication across all areas of the SEA. Data management is primarily located within the IT area on the SEA Data Management Council organization chart. Within this area, IT Support Services provides technical supervision for data management staff.

Next Steps:

1. IT will continue to provide technical supervision for staff responsible for data management.
2. IT will continue to facilitate communications with authoritative data sources within other areas of the SEA Data Management Council.

Question 2.4: What strategy will be used to retain data management staff?

Benchmark 2.4.1: Professional development opportunities are provided to staff to remain current with technology and departmental priorities. Staff are involved in departmental activities beyond data management.

The status for the SEA as of 05/13/08 is:

The SEA provides professional development opportunities and participation in departmental planning and coordination activities. No formal plan has been developed.

Next Steps:

1. A professional development plan will be developed that describes staff participation in professional meetings and training.
2. Management will build a plan to conduct activities that allow data management staff to interact with others in the SEA and to stay current with SEA issues and priorities.
3. IT will evaluate the effectiveness of professional development and make modifications to its plan as appropriate.



About ESP Solutions Group

ESP Solutions Group provides its clients with *Extraordinary Insight*™ into PK-12 education data systems and psychometrics. Our team is comprised of industry experts who pioneered the concept of “data driven decision making” and now help optimize the management of our clients’ state and local education agencies.

ESP personnel have advised school districts, all 52 state education agencies, and the U.S. Department of Education on the practice of K-12 school data management. We are regarded as leading experts in understanding the data and technology implications of the **No Child Left Behind Act (NCLB)**, **Education Data Exchange Network (EDEN)**, and the **Schools Interoperability Framework (SIF)**.

Dozens of education agencies have hired ESP to design and build their student record collection systems, federal reporting systems, student identifier systems, data dictionaries, evaluation/assessment programs, and data management/analysis systems.

To learn how ESP can give your agency *Extraordinary Insight* into your PK-12 education data, email info@espsg.com.

This document is part of *The Optimal Reference Guide Series*, designed to help education data decision makers analyze, manage, and share data in the 21st Century.

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