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Data Warehouse / Business Intelligence Strategy and Recommendations

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Executive Summary

This document presents the strategy for developing and implementing a data warehouse / business intelligence (DW/BI) environment for Loyola University. The first step to develop this strategy was to understand the reporting needs of the university. A series of 17 interviews with core groups across the institution were conducted from December 2008 – January 2009. Detailed results of the interviews are documented in the DW/BI Initial Assessment. The findings from these interviews show that there is strong interest and supporting requirements to build a historical institutional data repository to inform strategic decision-making across the institution. Data which is manually maintained, silo-driven, or isolated within an application is inefficient and contains inconsistent data definitions of key institutional data when viewed across functional and academic areas resulting in redundant initiatives to re-solve data accuracy problems.

University data is an institutional asset which must be protected and to appreciate its value we must know where the data is, how is it used, and how best to integrate it.   The value of this asset will be increased if there is a common understanding of the data. This can be achieved by integrating disparate data and applying consistent data governance rules and definitions to a centrally located data warehouse. It is recommended that Institutional Research (IR) lead this initiative since it has the responsibility for supplying official external and much of the internal institutional data. This knowledge can provide the foundation for institutional standard data definitions for the data warehouse. Functional area representatives can supply departmental definitions when they differ with the institutional ones for internal reasons.

The data warehouse will deliver reliable and usable institutional information by providing consistent and repeatable outcomes across all functional and academic areas.   Key performance indicators of data accuracy over time and data completeness can be measured for continuous data quality improvement.

Loyola already captures and stores a great deal of data, but it is often stored in "silos" and is not easy to access. Reporting requirements are being addressed in a variety of ways today. The primary requirements for data and reporting are:

- Provide an integrated authoritative source of data to use for reporting and analysis.
- Define, document, and publish definitions of the data along with recommendations for how it can/should be used.
- Provide an easy to use interface to allow groups to directly access the data needed to perform their work.
- Ensure that appropriate education is provided to ensure that data is used appropriately and effectively.
- Develop business and systems processes to systematically collect and store additional pertinent data, such as alumni contact information or student placements. This is often already captured today, but not stored in a consistent manner that is accessible across the University.

A DW/BI Strategy describes what the logical, physical and process environments must look like and outlines additional requirements to ensure that the DW/BI environment supports the University for the long term.

Figure 2 (page 4) shows the proposed Loyola data architecture.

Terms and Definitions

Data Warehouse: The database in which the data is organized to support the business is called the data warehouse. The data warehouse includes all of the data that is loaded into a single, integrated database and used together for analysis.

Business Intelligence: An application or reporting layer is provided to facilitate access and analysis of the data. This is where business users access reports, dashboards, and analytical applications. Collections of these reports and analyses are called business intelligence.

Challenges with the Current Reporting Environment

There is an ever increasing need for data to support the decision making processes of the institution. To meet these needs Loyola purchased the Reporting Data Service (RDS) and IBI'S WebFocus reporting tool. The Reporting Data Service (RDS) was implemented in 2004 as a reporting solution for the student information system (PeopleSoft/LOCUS). An upgrade to the RDS was required to support the student system upgrade in the summer of 2008. Initially, DW/BI solutions were reviewed in advance of that project; however, there was simply not enough time to develop the long-term DW/BI strategy in parallel with the larger upgrade effort. Therefore, an inexpensive, temporary solution to update the RDS to accommodate the upgrade was implemented with the understanding that we would revisit a long-term data warehouse and reporting solution at a later time.

RDS primarily contains current student data but lacks other university data and a historical repository for institutional data beyond student information. Many reports are being produced using the RDS but there are still data needs that are not being met with the current environment. Additionally, RDS has reached the end of its lifecycle and is limited in functionality, scalability and vendor support. While RDS has helped in many ways, several limitations and challenges of the current environment include:

- Data is not easily accessible.
- Data is often needed from multiple operational systems, which is not available in the RDS. This often requires that requests be made for each different source of data. The data must be integrated together to produce the true report that is needed.
- There is inconsistency across the organization since data is manipulated and integrated on a case by case basis.
- This approach requires time and effort to pull and manipulate data each time it is needed.
- The RDS reflects the same current view of data as the source systems.
- There is limited access to point in time snapshots of data.

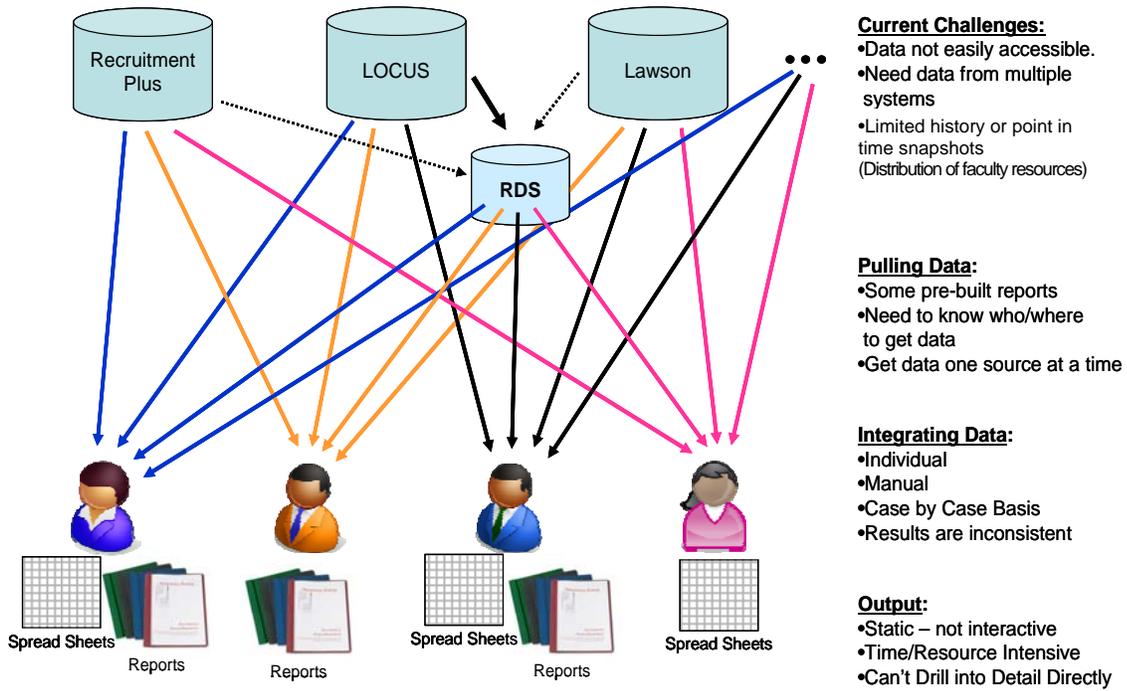Figure 1 (page 4) shows the current Loyola reporting environment.

Current Challenges:
•Data not easily accessible.
•Need data from multiple systems
•Limited history or point in time snapshots
(Distribution of faculty resources)

Pulling Data:
•Some pre-built reports
•Need to know who/where to get data
•Get data one source at a time

Integrating Data:
•Individual
•Manual
•Case by Case Basis
•Results are inconsistent

Output:
•Static – not interactive
•Time/Resource Intensive
•Can't Drill into Detail Directly
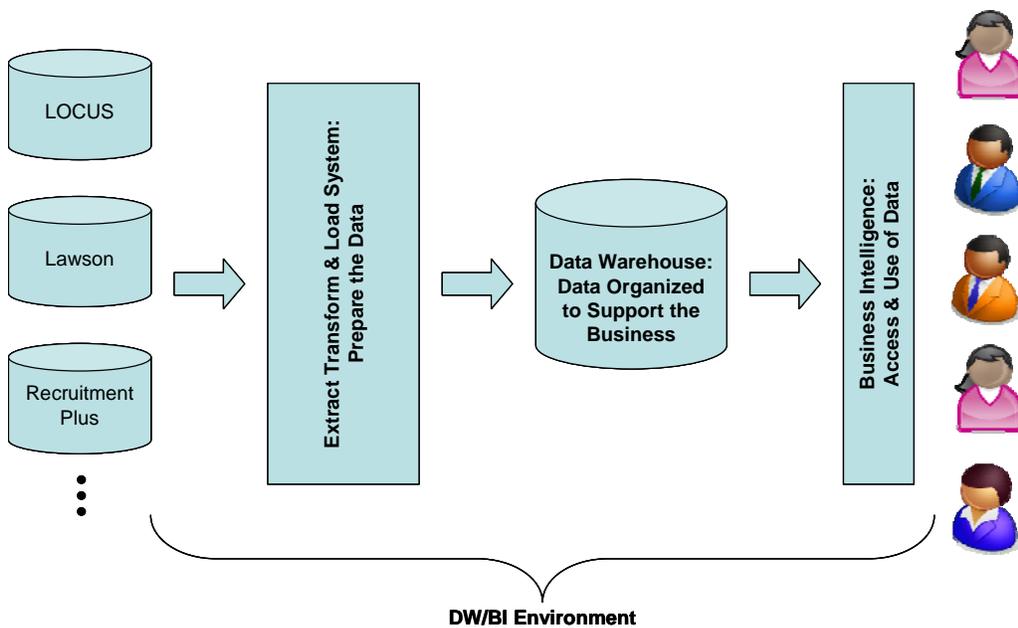
Figure 1. Current Loyola Reporting Environment

Figure 2. High-Level Vision for Loyola's DW/BI Environment

Enterprise DW/BI Goals, Value and Direction

The goal of Loyola's Enterprise Data Warehouse (DW) is to provide an integrated collection of data that can be defined and shared across the entire University by using common definitions. The data will be gathered from numerous sources (Student System, Human Resources, Finance, Institutional Research, Housing, etc) and organized into an integrated authoritative source of data for greater accessibility, reliability and efficiency. The DW/BI solution will provide a single integrated version of the data for reporting and analysis broadly available throughout the University in a model that is repeatable and reliable.

This DW/BI strategy for Loyola encompasses the database and the business intelligence tools. Data warehouse and business intelligence are intertwined and complement each other; one cannot successfully exist without the other. Taking it even further, this strategy lays out other factors that must be in place to ensure sustainable success.

We recommend that IR lead this effort, since they are already chartered with the responsibility for all official external and internal institutional reporting.

The DW/BI Strategy

The DW/BI strategy is comprised of 3 main components that are outlined below. These components are:

- ***(Logical) Data architecture*** describes how data is organized and structured to support the development, maintenance, and use of the data by application systems. This includes guidelines and recommendations for historical retention of the data, and how the data is to be used and accessed.

- ***(Physical) Technical architecture*** addresses the organization and structure of the collection of hardware and software technologies that are installed to support the development and delivery of the data warehouse. One possible technical architecture would be to utilize the mature infrastructure and resources currently supported by ITS, such as the Oracle database platform and Cognos's DecisionStream for the DW component and IBI's WebFocus for the BI component. There are other technical alternatives that warrant further investigation, such as purchasing pre-built BI applications and/or pre-built higher education data models. This strategy recommends that both internal resources (Institutional Research, Academic and Functional department, ITS) and external DW/BI consulting be utilized to ensure timely completion and long term sustainability.

- ***(Process) Data governance*** is the practice of organizing and implementing policies, procedures, and standards for the effective use of an organization's structured or unstructured information assets. Each of the data governance activities are described in depth later in this document. Data governance is important and requires the involvement and participation of all functional areas of the university.   Core activities of data governance include:
  - ❖ data ownership
  - ❖ data labels and definitions
  - ❖ development of a data dictionary
  - ❖ data quality

- ❖ data education
- ❖ procedures for introducing new data to the data warehouse

This group will also help resolve data issues and establish interdependent data usage and data definitions. This group will also determine when and how issues are to be escalated. Based on the results of the initial assessment, this data governance group would likely include the following representatives:

- Institutional Research
- Information Technology Services
- Registration and Records
- Student Enrollment
- Human Resources
- Finance
- Student Affairs

Additional resources may be needed, over time, to support specific types of data.

Strategic Recommendations

1. Create a DW/BI Program Management structure and data governance teams for this initiative. This first year also involves putting in place the foundation for all future additions to the DW/BI environment.

2. Investigate and evaluate technical alternatives for building the DW/BI environment. (Custom, Hybrid, Package). Build detailed budget; identify required resources.

3. Institutions who have successfully developed and deployed DW/BI solutions acknowledge that it must be a collaborative effort led by Institutional Research including functional departments, academic areas and ITS. Of the opportunities identified in the interviews, one of the following opportunities should be considered for Year One implementation because of their immediate impact on these focus areas in the 2009 – 2014 LUC Strategic Plan:

- Student Financial Analysis – Combine current and historical student data to study the increased financial need of students
- Course Enrollment Management - Analyze who is teaching which courses to which student populations. This can help evaluate and monitor the quality of education. (e.g. Faculty Load Report)
- Recruiting – Combine student data with recruitment data to better identify candidates who are likely to attend and be successful at Loyola. (e.g. Summary Funnel Report)
- Student Retention – Combine recruitment and current student data to provide the data needed to better understand the core factors that influence student retention. (e.g. Attrition Graduation Rates Report)
- Other – ITESC recommendation

Over the next 5 years, additional data, functionality and applications will be added to the data warehouse in a phased approach based upon review and prioritization process. A DW/BI solution is a long-term strategic investment that is implemented in phases and spans 5-10 years with appropriate resources and support from the institution. In summary, support for moving

Loyola to an institutional data repository was clear in the interviews.

Figure 2 (page 4) shows a proposed view of Loyola's future DW/BI environment.

Critical Success Factors

Successful deployment requires more than building the DW/BI environment, installing technology, and building the database. The following are critical success factors for a sustainable DW/BI solution for the University:

- Treat data as an institutional asset.

- Address demand for training and support.

- Openness to change how work is done – some business processes may need to change or be modified.

- Invest in data governance for the long term.

- An Enterprise DW/BI is a process and not a single project. This should be considered a strategic initiative that will continue to evolve over time.

- Success requires a strong partnership between ITS and Functional Areas. This is achieved through participation, cooperation, and collaboration.

- Cooperation and collaboration between the functional areas to openly communicate functional improvements, ideas and operational concerns.

- Requires strong executive sponsorship, support and follow through.

- Develop and expand current reporting to enable more complex and sophisticated analysis.

- Continuing to leverage existing executive governance committees that are already in place, including the PRB and the ITESC.

Next Steps

1) Confirm decision to move forward to implement an Enterprise DW/BI Solution for Loyola.

2) Create a DW/BI Program Management structure and data governance teams for this initiative.

3) Investigate and evaluate technical alternatives for building the DW/BI environment. (Custom, Hybrid, Package). Build detailed budget; identify required resources.

4) Select the business opportunity to pursue for the first DW/BI project (student recruitment, student retention or student financial analysis).

5) Define and launch the first DW/BI project. The specific characteristics of this initial project will depend upon the opportunity that is selected and the technical architecture that will be used.

Proposed DW/BI Implementation Timeline

Milestone	Duration
Project approval at ITESC	1 Day
Program Management and Data Governance Group a) Develop Charter/Missions b) Membership Selection	 1 Month 1 Month
Enterprise DW/BI Requirements a) Develop RFP b) Vendor Response c) Evaluate Vendor Responses d) Strategy Decision	 2 Months 1 Month 1 Month 1 Month
Initial Project Selection	2 Months
Define and Launch Program	TBD

Total duration of initial implementation: approx. 9+ months