

*Teaching Case*  
**An Interdisciplinary Task-Based Activity for  
Teaching Internal Controls**

Thomas E. Marshall, Dawna M. Drum, Sherwood L. Lambert,  
and Steven A. Morris

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# **Teaching Case**

## **An Interdisciplinary Task-Based Activity for Teaching Internal Controls**

**Thomas E. Marshall**

Department of Accounting  
University of New Orleans  
New Orleans, LA 70148, USA  
[temarsha@uno.edu](mailto:temarsha@uno.edu)

**Dawna M. Drum**

Department of Accounting  
Western Washington University  
Bellingham, WA 98225, USA  
[dawna.drum@wwu.edu](mailto:dawna.drum@wwu.edu)

**Sherwood L. Lambert**

Department of Accounting  
University of West Florida  
Pensacola, FL 32514, USA  
[llambert@uwf.edu](mailto:llambert@uwf.edu)

**Steven A. Morris**

Department of Computer Information Systems  
Middle Tennessee State University  
Murfreesboro, TN 37132, USA  
[steven.morris@mtsu.edu](mailto:steven.morris@mtsu.edu)

### **ABSTRACT**

This case addresses the critical topic in education of developing students' skills and capabilities associated with enterprise-level business intelligence systems and associated internal control concerns. The experiences of using a business intelligence, task-based activity in an interdisciplinary curriculum model are presented and discussed. Pedagogically, the task-based activity enhances perceived learning for both accounting and IS disciplines in domain (internal controls and IS development), communication (comprehension and creation), and critical thinking skills. Additionally, students appreciate the realism and active learning associated with the task-based activity delivered in an interdisciplinary curriculum model. The design of the task-based activity as a teaching resource allows other instructors, based on their requirements, to develop a lesson plan around using the activity as written, or focusing on the any of the many aspects of controls or technology presented.

**Keywords:** Business intelligence, IT internal controls, Risk assessment

### **1. INTRODUCTION**

Business Intelligence (BI) initiatives allow enterprise system users to derive more value from the information stored in

traditional, inflexible systems. These BI systems are often enterprise level in scope and inter-departmental in operation due to the many sources of information that must be integrated and then disseminated across the organization (Kretzer and

Maedche, 2014). Many participants should contribute to a successful BI initiative, including subject matter experts, information technology specialists of many kinds, and internal auditors. Therefore, it is critical that educators find ways to cross functional boundaries as well as incorporate BI and other enterprise level technology concepts into as many business courses as possible.

Integrating technologies into the university curriculum model is critical to offering a quality, contemporary education. The pedagogical benefits of including technologies in the curriculum model are subject to little debate, but academia faces significant challenges in implementing technologies into the learning environment (Wixom et al., 2011; Wixom et al., 2010). Educators, therefore, find themselves under increasing pressure to find viable sources of enterprise-level technology to support their pedagogical efforts. Additionally, the value of interdisciplinary curricula has been recognized and mandated by our educational governance bodies, such as AACSB. To prepare for the future, academia should recognize societal trends towards cross-functional teams and design pedagogy to integrate related technology into the curriculum (AACSB, 2016; Le and Lehmann, 2016; McHaney et al., 2015).

Recognizing that professional technology use occurs within an organizational context provides a basis for an interdisciplinary teaching case design that includes multiple organizational units, leading technologies, and inter-organizational dynamics (Etnyre and Lehmann, 2015).

## **2. A BRIEF REVIEW OF THE LITERATURE**

Interdisciplinary project teams are a fact of life in most organizations, with participants from various departmental units coming together to accomplish the goals and projects of the organization. Professionals are frequently required to participate on interdisciplinary project teams, but evidence suggests that disconnects exist (Gray et al., 2011; Henry, 2008; Worrell, Bush, and Di Gangi, 2014). Coordination between dissimilar groups necessitates clear and concise communication which, if found lacking, could affect the trust between the groups. Trust between members of dissimilar groups is a key factor in the ability of groups to work successfully together (Ferrin, Bligh, and Kohles, 2007; Lee, Stajkovic, and Sergent, 2016).

Information technology and accounting professionals, in particular, often work together on high-stakes information systems projects, and project performance is not always optimal (Dwivedi et al., 2015; Lee, Stajkovic, and Sergent, 2016). Troubled projects are often continued or escalated when they should be abandoned or de-escalated, and there are a wide variety of project, societal, organizational, and psychological factors for this escalation (Keil, 1995; Keil, Depledge, and Rai, 2007). Possible causes for poor information systems performance include a misalignment among four types of controls, including the control environment, mechanisms, execution of control, and socio-emotional behaviors (Cram et al., 2016).

Compliance and controls can at times place the IT department and the internal audit function in precarious relationships regarding organizational initiatives such as BI systems (Etnyre and Lehmann, 2015). Accountants frequently participate on BI teams offering their expertise in issues

involving risk, security, and compliance, and they issue formal reports regarding internal controls and regulatory compliance through the Internal Audit Department (IAD) function. Cross-functional awareness does not happen automatically and must be fostered through constant communication between organizational groups to enable them to place enterprise level objectives above those of their department or domain (Marciniak et al., 2014). This dynamic relationship between IT, IAD, and upper management presents an opportunity to develop an interdisciplinary learning experience, including enterprise level systems as a dynamic catalyst.

Educators and others often assume that business students share preferences for many work-related topics such as analytical skills or communication styles. This is not the case, however, and “deep gulfs” actually exist between the sub-disciplines within professional schools (Gilbert, Burnett, and Leartsurawat, 2010). These variations must be addressed in the academic setting for interdisciplinary teams to be successful in a professional setting.

## **3. THE CASE**

This teaching case is based on a system developed in a tutorial created by Oracle, Inc., for training BI system developers on their Oracle Data Integrator product known as “ODI” (<http://www.oracle.com/technetwork/community/developer-vm/index.html#odi>). It is an analysis of the system documentation, rather than of the actual system developed. This represents a multidisciplinary activity allowing students to critically analyze the proposed system, with respect to internal controls and project management, and has been effectively used in Accounting Information Systems, Introductory Information Systems, and Information Systems Development courses. The case includes simulated inter-departmental interactions between the Internal Audit Department (IAD) and the BI development team through the use of an audit report. To heighten the organizational dynamics of the experience, team members exercise critical thinking skills in communicating with the president of the organization regarding the viability of the project. Using a novel and economical approach to providing enterprise level technology across disciplines supports the objectives of developing rich interdisciplinary learning experiences in a cost-effective manner.

Students will read the accompanying simulated system documentation, “Sales Administration Intelligence System ETL Guide.” Students will then read an accompanying audit report based on the system documentation and will discuss whether they think the proposed project should be continued, supported by evidence from the audit report and their knowledge of internal controls and basic systems principles. The case can be taught as an in-class discussion (using only the included project material and audit report) or a written submission (using the same project documents with the addition of the email assignment) for IT, general business, or accounting students.

### **3.1 The Scenario**

Lotsa Protein is a maker of meat snacks such as beef jerky and individually packaged sausages. Riding the wave of high-protein, low-carbohydrate diets, sales have soared and the president, Terry Lots, has formed a Business Analytics Unit

(BAU) to develop a new Sales Administration Intelligence System (SAIS) to improve information quality and availability for the large sales team. The BAU members include key employees from Sales and Marketing who have been working with consultants from Oracle, Inc., but no members from IT or Accounting have been included in the BAU. Internal Audit recently completed a new systems development audit of the SAIS system for compliance with internal controls and policies. Terry has asked you to review both the SAIS project documentation and the internal audit report, and write a brief recommendation stating your opinion of the conclusions in the internal audit document and whether or not the project should continue. Clearly state your position and back it up with specific information found in either the SAIS documentation or in the internal audit report.

### 3.2 SAIS Project Documentation

The Sales Administration Intelligence System Project Documentation has been written by the BAU team with help from Oracle consultants. See Appendix A for a copy of the project documentation.

### 3.3 Internal Audit Report

The Internal Audit Report has been written by the Internal Audit team. See Appendix B for a copy of this report.

## 4. REFERENCES

- AACSB. (2016). Eligibility Procedure and Accreditation Standards for Accounting Accreditation.
- Cram, W. A., Brohman, M. K., Chan, Y. E., & Gallepe, R. B. (2016). Information Systems Control Alignment: Complementary and Conflicting Systems Development Controls. *Information & Management*, 53(2), 183-196.
- Dwivedi, Y. K., Wastell, D., Laumer, S., Henriksen, H. Z., Myers, M. D., Bunker, D., Elbanna, A., Ravishankar, M. N., & Srivastava, S. C. (2015). Research on Information Systems Failures and Successes: Status Update and Future Directions. *Information Systems Frontiers*, 17(1), 143-157.
- Etnyre, V. & Lehmann, C. (2015). Use of Software and Collaboration Tools to Integrate AIS and MIS Curricula. *AIS Educator Journal*, 10(1), 43-67.
- Ferrin, D. L., Bligh, M. C., & Kohles, J. C. (2007). Can I Trust You to Trust Me? A Theory of Trust, Monitoring, and Cooperation in Interpersonal and Intergroup Relationships. *Group & Organization Management*, 32(4), 465-499.
- Gilbert, G. R., Burnett, M., & Learturawat, W. (2010). The Psychological Work Preferences of Business Students. *Journal of Career Assessment*, 18(2), 189-206.
- Gray, G., Turner, J., Coram, P., & Mock, T. (2011). Perceptions and Misperceptions Regarding the Unqualified Auditor's Report by Financial Statement Preparers, Users, and Auditors. *Accounting Horizons*, 25(4), 659-684.
- Henry, E. (2008). Are Investors Influenced by how Earnings Press Releases are Written? (Report). *The Journal of Business Communication*, 45(4), 363.
- Keil, M. (1995). Pulling the Plug: Software Project Management and the Problem of Project Escalation. *MIS Quarterly*, 19(4), 421-447.
- Keil, M., Depledge, G., & Rai, A. (2007). Escalation: The Role of Problem Recognition and Cognitive Bias. *Decision Sciences*, 38(3), 391-421.
- Kretzer, M. & Maedche, A. (2014). Generativity of Business Intelligence Platforms: A Research Agenda Guided by Lessons from Shadow IT. In *Proceedings of MKWI 2014*.
- Le, N. & Lehmann, C. M. (2016). Purchasing Process Internal Control Assessment: A Comprehensive Case Study using Data Analytic Software. *AIS Educator Journal*, 11(1), 9-15.
- Lee, D., Stajkovic, A. D., & Sergent, K. (2016). A Field Examination of the Moderating Role of Group Trust in Group Efficacy Formation. *Journal of Occupational and Organizational Psychology*, 89(4), 856-876.
- Marciniak, R. E. L., Amrani, R., Rowe, F., & Adam, F. (2014). Does ERP Integration Foster Cross-Functional Awareness? Challenging Conventional Wisdom for SMEs and Large French Firms. *Business Process Management Journal*, 20(6), 865-886.
- McHaney, R., Warkentin, M., Sachs, D., Pope, M. B., & Ormond, D. (2015). Teaching Social Media in Business. *Journal of Information Technology Education: Innovations in Practice*, 14, 39-62.
- Wixom, B., Ariyachandra, T., Goul, M., Gray, P., Kulkarni, U. R., & Phillips-Wren, G. E. (2011). The Current State of Business Intelligence in Academia. *Communications of the Association for Information Systems*, 29, 16.
- Wixom, B., Watson, H., Marjanovic, O., & Ariyachandra, T. (2010). Educating the Next Generation BI Workforce. *International Journal of Business Intelligence*, 15(3), 26-31.
- Worrell, J. L., Bush, A. A., & Di Gangi, P. M. (2014). Cousins Separated by a Common Language: Perceptions of Information Technology Risk. *International Journal of Digital Accounting Research*, 14(20), 1-34.

#### AUTHOR BIOGRAPHIES

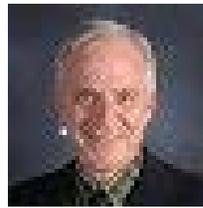
**Thomas E. Marshall** is currently an Associate Professor at Christian Brothers University. Dr. Marshall has a Ph.D. in business information systems from the University of North Texas, and he holds his C.P.A. designation in the State of Louisiana. He has published numerous research articles, many with a focus on database systems, business intelligence, intelligent systems, decision support systems, accounting information systems, information security and assurance, and big data. He has participated on federally funded grants, including grants from the U.S. Department of Commerce, addressing intelligent systems for competitive advantage in the U.S. textile industry. Dr. Marshall has also participated on federal grants developing biosecurity systems. Other funded projects have involved health information technology associated with healthcare provider interoperability, state health information exchanges, and healthcare technology innovations. His consulting activities include developing databases and decision support systems supporting state Medicaid processes. Dr. Marshall has also provided consulting services to the U.S. Air Force developing decision support systems that have been used to identify unexploded bomb locations associated with the Vietnam War and Pentagon evaluation of Air Force officer promotions.



**Dawna M. Drum** is currently an Assistant Professor of Accounting at Western Washington University in Bellingham, WA. Her Ph.D. is in Technology Management from Indiana State University. She teaches courses in Accounting Information Systems and Accounting Analytics, and she is the 2019 President of the AIS Educators Association ([www.aiseducators.org](http://www.aiseducators.org)). Prior to earning her Ph.D., Dr. Drum was in the IT industry for over 20 years supporting ERP and accounting systems for a variety of industries. She has published many articles and teaching cases, primarily focusing on workarounds in enterprise systems and the uses of accounting information.



**Sherwood L. Lambert** is currently an Associate Professor of Accounting at the University of West Florida in Pensacola, FL. He earned his Ph.D. in Business Administration – Accounting from the University of Texas – Arlington in 2011. He also holds an M.B.A. from Texas Christian University and Master of Science in Information Systems and Bachelor of Science in Mathematics degrees from UTA. He has been a C.P.A. in Texas since 1998. Prior to obtaining his Ph.D., he worked for 18 years with Lockheed Martin Corporation as an ERP systems specialist and for 3 years with Deloitte & Touche, LLP, as Manager and Senior Manager of Enterprise Risk Services. His primary teaching responsibilities, which are also the focus of his research and creative activities, are Accounting Information Systems and Managerial and Cost Accounting.



**Steven A. Morris** earned his Ph.D. in Management Information Systems from Auburn University. He is a Professor in the Information Systems and Analytics department in the Jones College of Business at Middle Tennessee State University. Dr. Morris teaches classes in Database Design and Development, Advanced Database Programming, and Big Data for Analytics. Dr. Morris actively consults with businesses in the Middle Tennessee area on database-related projects. Dr. Morris has published dozens of articles in scholarly journals on diverse topics including databases, project management, virtual teams, and pedagogical issues. He is also the co-author of *Database Systems: Design, Implementation, and Management*, a textbook that is currently in its 13th edition.



**APPENDIX A**

**Memo**

To: Accounting and IT Teams From:  
Business Analytics Unit  
Subject: Review of Sales Administration Intelligence System Documentation

The attached report describes the Sales Administration Intelligence System (SAIS) being developed internally by the Business Analytics Unit (BAU).

We are asking the Accounting and IT Teams to perform a review of the SAIS document as a representation of the system described and the ability of the system to meet specified requirements. This document has already been routed to the Internal Audit Department for the review, but we have not yet received their response.

Your review should include an assessment of the risks associated with the proposed information system and a brief discussion of any IT and/or non-IT internal controls that might reduce the risks that you identify. Please be prepared to share your thoughts at our next meeting.

Sales Administration Intelligence System  
 Extract, Transform, and Load (ETL) Production Document

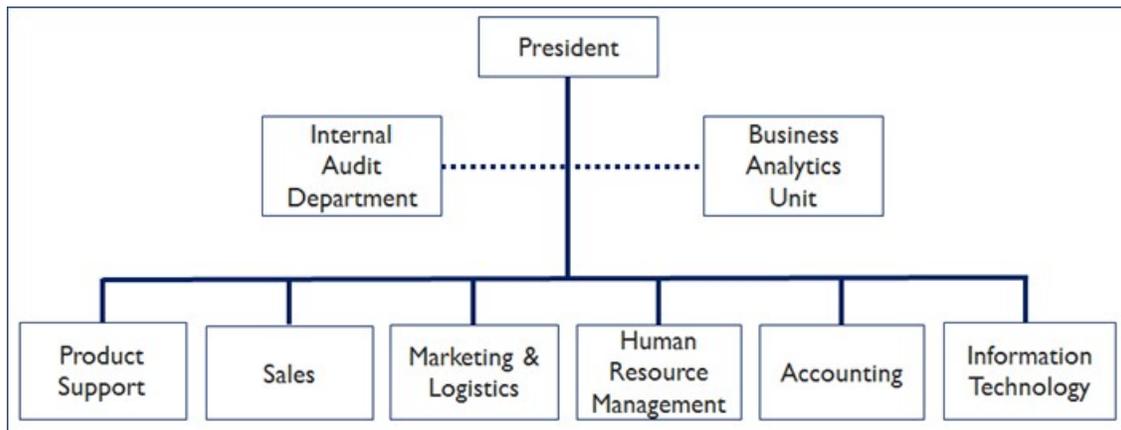
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**Sales Administration Intelligence System (SAIS)**

As an enterprise system, the Sales Administration Intelligence System (SAIS) is a comprehensive system to extract, transform, and load (ETL) data into a repository supporting intelligence applications for subject areas related to Orders, Sales, Marketing & Logistics, and Product Support. (Intelligence applications provide information that supports management decision making. In contrast, transaction processing systems such as Enterprise Resource Planning (ERP) and Accounting Information Systems (AIS) support recording, processing, and summarizing the day-to-day, business cycle transactions.) Currently, the SAIS includes order data from the Sales Department and sales person data from Human Resources Management (HRM). SAIS extracts this data from the relational database within the company's ERP system. Future SAIS enhancements include services and data exchange with Marketing & Logistics and Product Support. Future expectations for SAIS include the ability to process big data from various departments and industry sources.

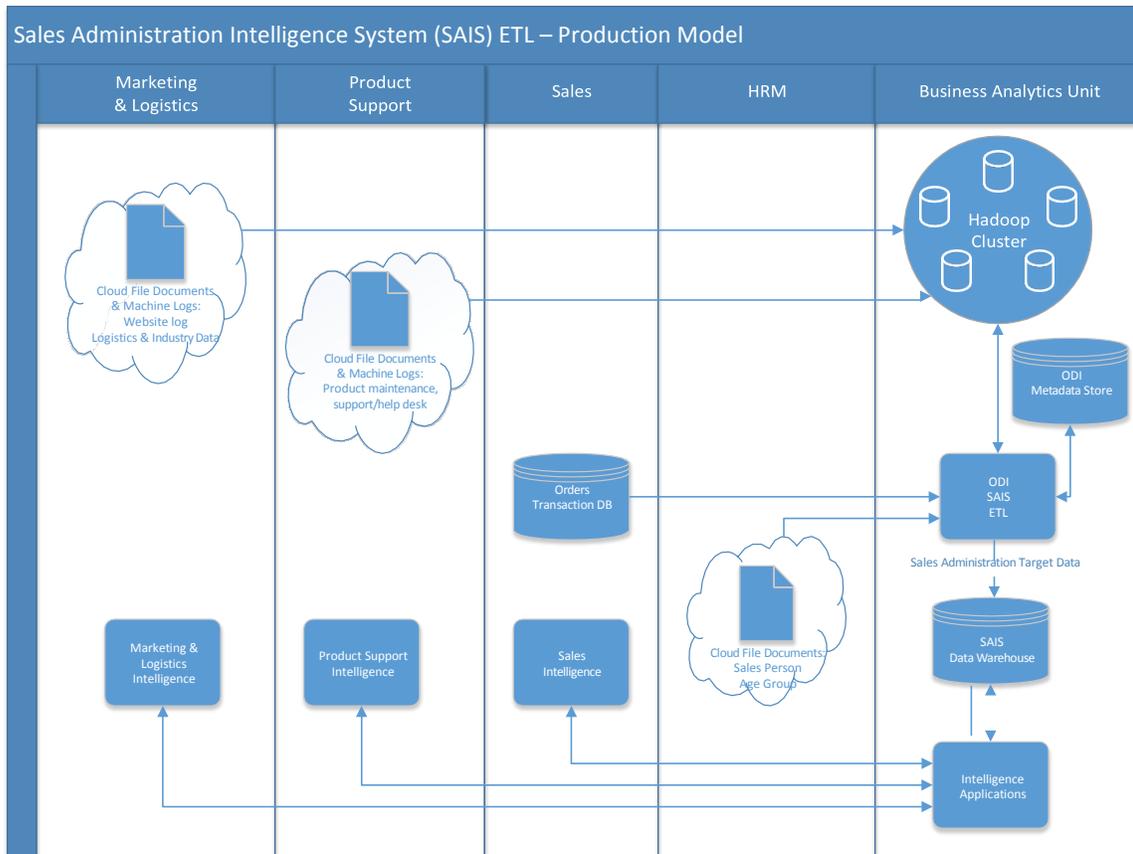
The Business Analytics Unit (BAU) has been designated as the organizational unit responsible for the SAIS ETL – Production system. Staff in the BAU originated in the Sales Department and were recognized for providing management data for decision making within the department. The BAU is responsible for design, development, and production environments for the SAIS. Operationally, BAU coordinates the dataflow between departments, controls ETL processing, and is responsible for production and operations for the SAIS. BAU does not control information system resources outside of the BAU itself. The Marketing & Logistics, Product Support, and Sales departments work directly with BAU on maintenance and enhancement issues related to their respective intelligence system. The Accounting and Information Technology departments work indirectly with BAU, providing assurance and technical advice, but having no direct input on the system. The Internal Audit Department also provides advice to the BAU, but has direct authority to request changes they may feel are necessary for proper internal controls.



BAU plans to develop and implement intelligence systems incrementally by department. The Sales Department intelligence system is in development at this time. BAU expects to put the first version of the Sales Intelligence system into operation in the near future. After implementation of the Sales Intelligence system, BAU plans to develop systems for Marketing & Logistics and Product Support. Marketing & Logistics and Product Support will involve exceptionally large datasets that will require new technologies for the BAU.

Top management is anxious to have an operational enterprise level intelligence system as they are facing increasing domestic and international competition. Management expects to use SAIS to monitor organization performance and to predict future sales and marketing opportunities. As an incentive for adoption, management plans to use the SAIS to determine incentive and performance compensation for executives and senior managers.

Figure 1. SAIS ETL – Production Dataflow Model

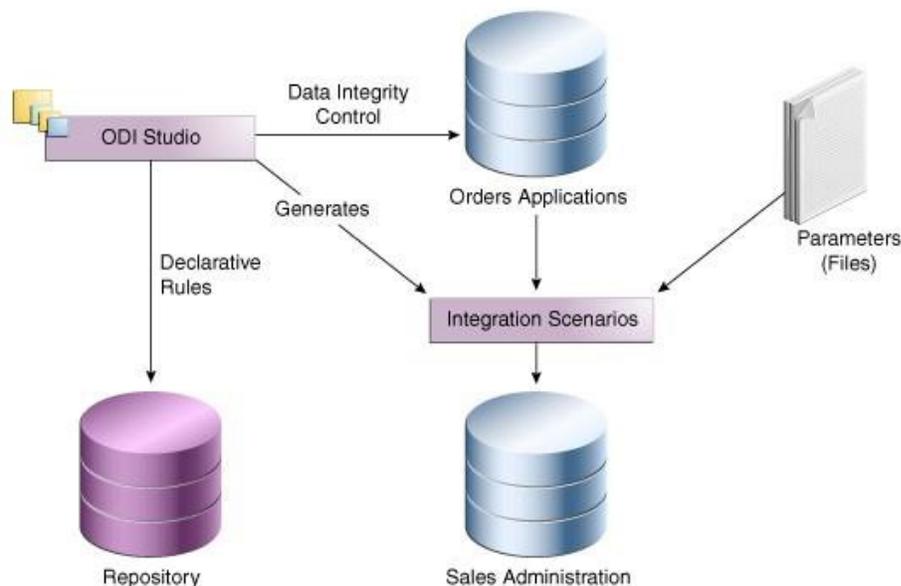


## The Development Environment

The development environment provides a visual process-oriented methodology to migrate, transform, and check the integrity of the data in the SAIS. SAIS requirements include the ability to ingest data from heterogeneous data sources and the ability to support environments associated with big data. The BAU currently is integrating heterogeneous data sources and plans to incorporate big data into the SAIS in the future.

Figure 2 shows the development environment for the current SAIS.

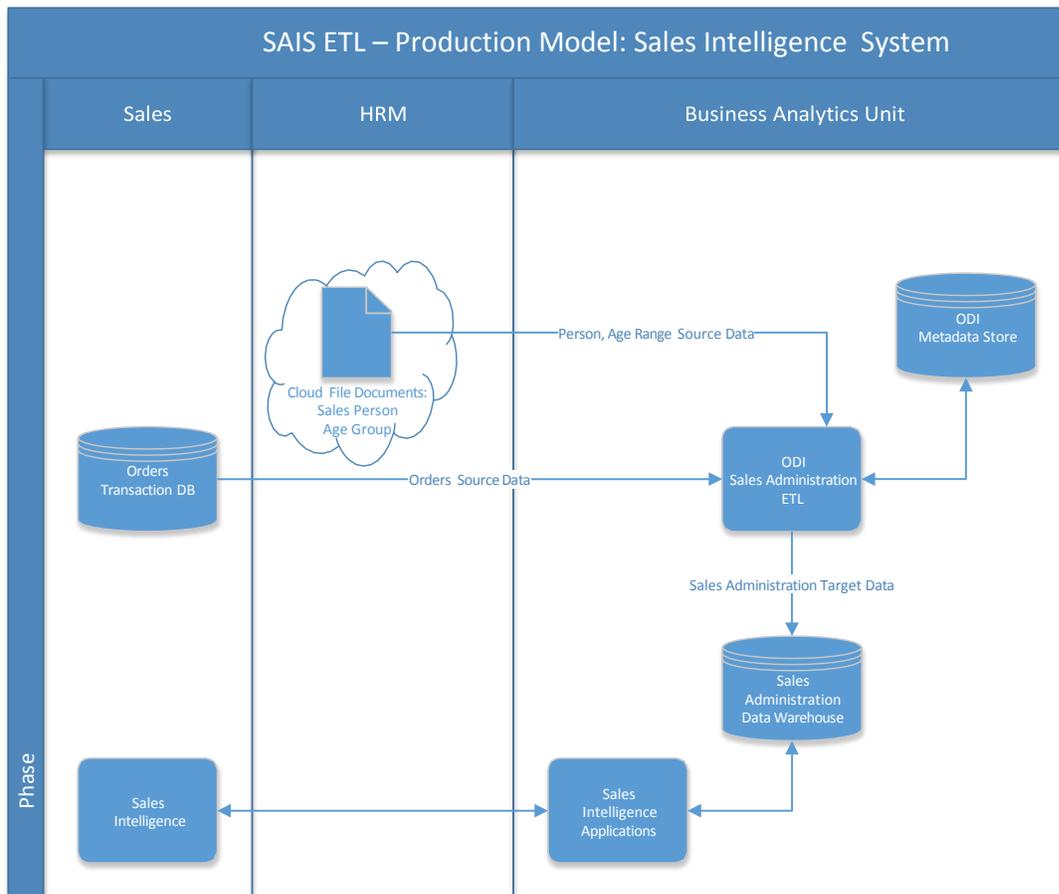
Figure 2. Development Environment



The development environment uses the following elements:

- Oracle Data Integrator (ODI) Studio that is an off-the-shelf (OTS) system provided by Oracle Corporation that integrates data for big data applications. ODI relationships are more complex than the one-to-many relationships used to relate tables in relational databases.
- *The Repository*: The Repository contains all of the metadata required for the SAIS.
- *Orders Applications*: An application for tracking customer orders, hosted in the Oracle database.
- *Parameters*: Flat files (ASCII), located in the cloud, issued from the production system containing a list of sales representatives and the segmentation of ages into age ranges.
- *Sales Administration*: The administration or tracking of sales, hosted in another Oracle database. This data warehouse is populated with our transformations.

Figure 3. Current Sales Administration ETL – Production Dataflow Model



### The Data Models

The current SAIS environment includes three ODI data models:

- Orders Application
- Parameters
- Sales Administration

This section provides the schema diagrams for these data models.

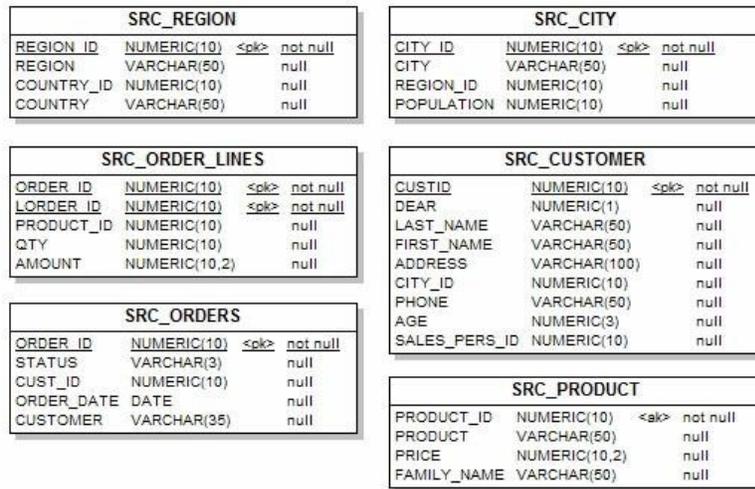
#### Orders Application

The *Orders Application* data model is based on the Oracle RDBMS technology and includes six data stores:

- SRC\_CITY
- SRC\_CUSTOMER
- SRC\_ORDERS
- SRC\_ORDER\_LINES
- SRC\_PRODUCT
- SRC\_REGION

Figure 4 shows the schema diagram of this data model. Note that this data model does not enforce any foreign key constraints, even if some functional relations exist between the data.

Figure 4. Orders Application Schema Diagram



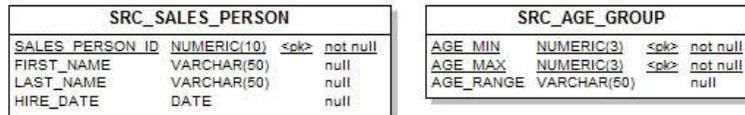
*Parameters*

The *Parameters* data model is based on the Cloud-File technology and includes two data stores:

- SRC\_SALES\_PERSON
- SRC\_AGE\_GROUP

Figure 5 shows the schema diagram of this data model.

Figure 5. Parameters Schema Diagram



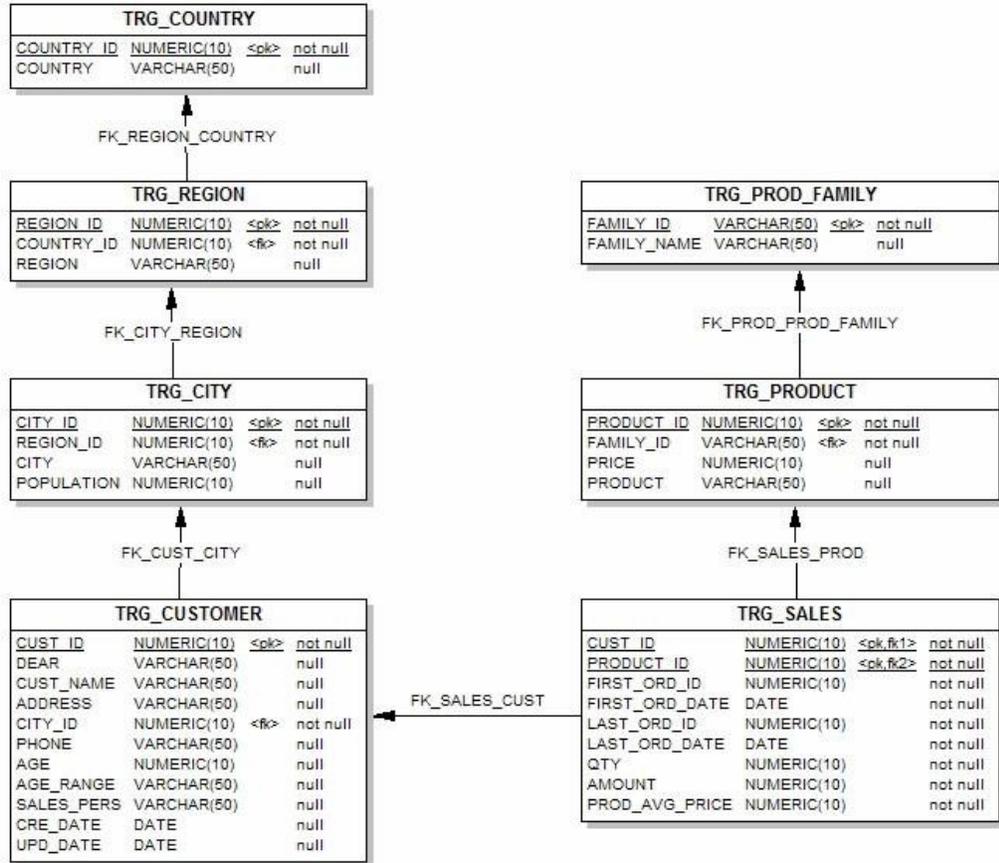
*Sales Administration – Oracle*

The *Sales Administration* data model is based on the Oracle RDBMS technology and includes seven data stores:

- TRG\_CITY
- TRG\_COUNTRY
- TRG\_CUSTOMER
- TRG\_PRODUCT
- TRG\_PROD\_FAMILY
- TRG\_REGION
- TRG\_SALES

Figure 6 shows the schema diagram of this data model. Note: Constraints in model, e.g., not null, PK, FK

Figure 6. Sales Administration Schema Diagram



**Integration Challenges**

The challenges related to data integration and transformation are:

- Accurately and easily exchange data between applications while respecting business rules of the respective system
- Automate end to end process flows
- Control and visibility over the entire set of data integration processes

The development process consists of:

- Create mappings and datastores to move and transform data
- Automate the execution of these mappings into packages
- Prepare the developed components for deployment
- Implement Data Quality Control to check data in a database

**TRG\_CUSTOMER – Mapping/Datastore:**

*Purpose and Integration Requirements*

This section describes the integration features and requirements the mapping Load TRG\_CUSTOMER is expected to meet.

The purpose of the Load TRG\_CUSTOMER mapping is to load the data from the SRC\_CUSTOMER table in the *Orders Application* model into the TRG\_CUSTOMER target table in the *Sales Administration* model.

However, the SRC\_CUSTOMER table does not contain all of the data that is required for this operation. The following information has to be added to the target table:

- The age range (AGE\_RANGE) that is defined in the SRC\_AGE\_GROUP flatfile in the *Parameters* model corresponds to the AGE attribute in the source table.
- The last and first names of the customer sales rep. (LAST\_NAME and FIRST\_NAME) that is defined in the SRC\_SALES\_PERSON file in the *Parameters* model correspond to the sales representative ID (SALES\_PERS\_ID) in the source table.
- The transformed value of the numeric data (0, 1, 2) from the DEAR column in the source table into a standard salutation text string in the target (Mr, Mrs, or Ms).
- The concatenated first and last names of the source customers.

The source data is not always consistent with the integrity rules implemented in the target environment. For this mapping, the data has to be cleansed by verifying that all constraints are satisfied and by storing invalid rows in an error table rather than in our target database.

In this example, two important integrity rules must be satisfied:

- Customers must be older than 21 (condition AGE >21)
- The customers must be associated with a city (CITY\_ID) that exists in the TRG\_CITY table (reference FK\_CUST\_CITY)

Figure 7. TRG\_CUSTOMER Mapping – Join Focus

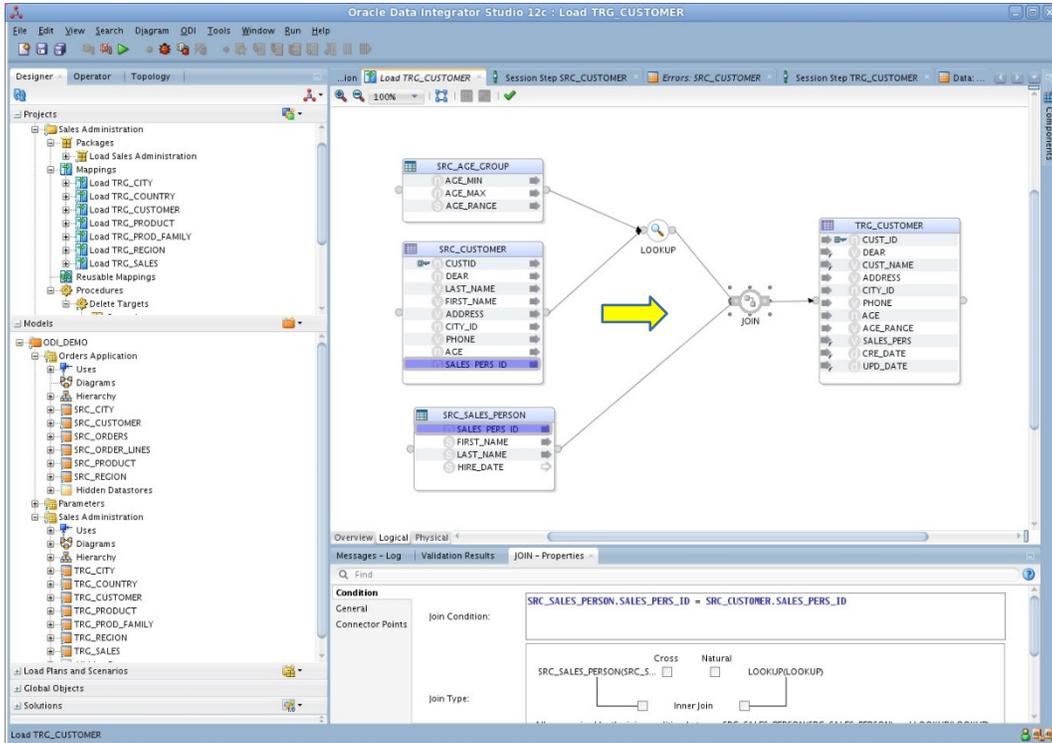


Figure 8. TRG\_CUSTOMER Mapping – Lookup Focus

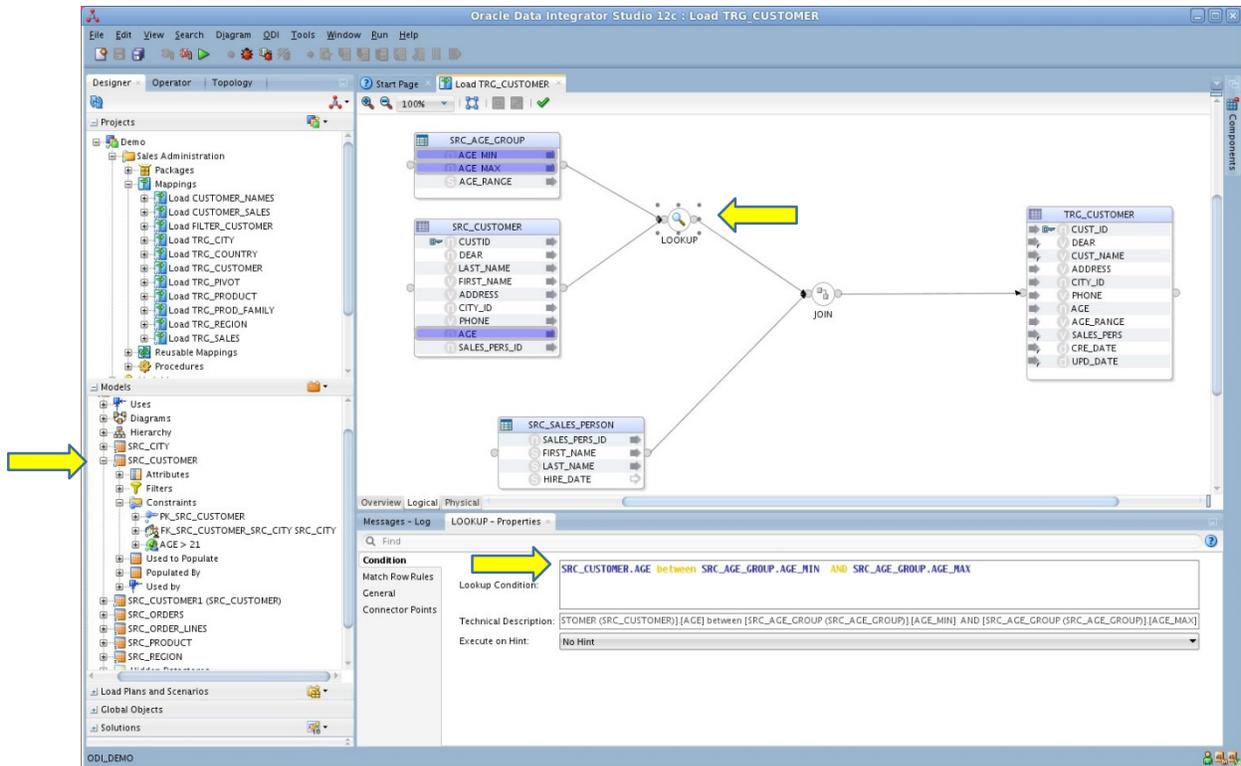
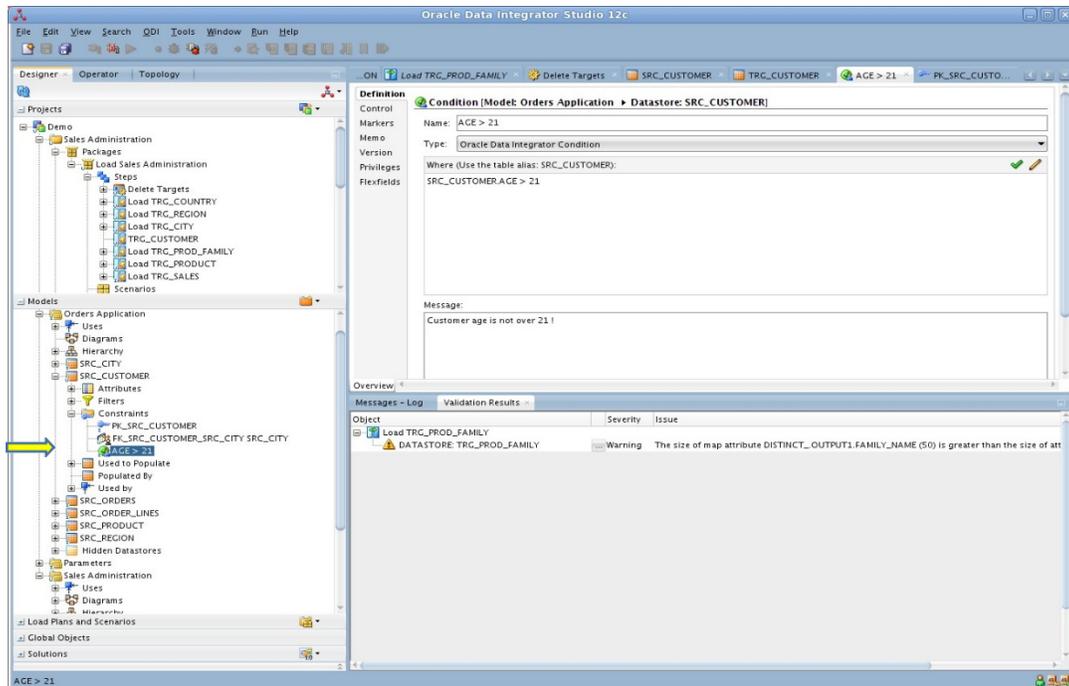


Figure 9. SRC\_CUSTOMER Mapping – Constraint Age > 21



### TRG\_SALES – Mapping/Datastore:

#### *Purpose and Integration Requirements*

This section describes the integration features and requirements the mapping Load TRG\_SALES is expected to meet.

The purpose of this mapping is to load the SRC\_ORDERS table of orders and the SRC\_ORDER\_LINES table of order lines from the *Orders Application* model into the TRG\_SALES target table in the *Sales Administration* model. The data must be aggregated before it is integrated into the target table. Only orders whose status is CLO are to be used.

However, the source data is not always consistent with the integrity rules present in the target environment. For this transformation, we want to cleanse the data by verifying that all of the constraints are satisfied. We want to place any invalid rows into an error table rather than into our target database. In our case, two important integrity rules must be satisfied:

- The sales must be associated with a product (PRODUCT\_ID) that exists in the TRG\_PRODUCT table (reference FK\_SALES\_PROD)
- The sales must be associated with a customer (CUST\_ID) that exists in the TRG\_CUSTOMER table (reference FK\_SALES\_CUST)

Figure 10. TRG\_SALES Mapping – Aggregation Focus

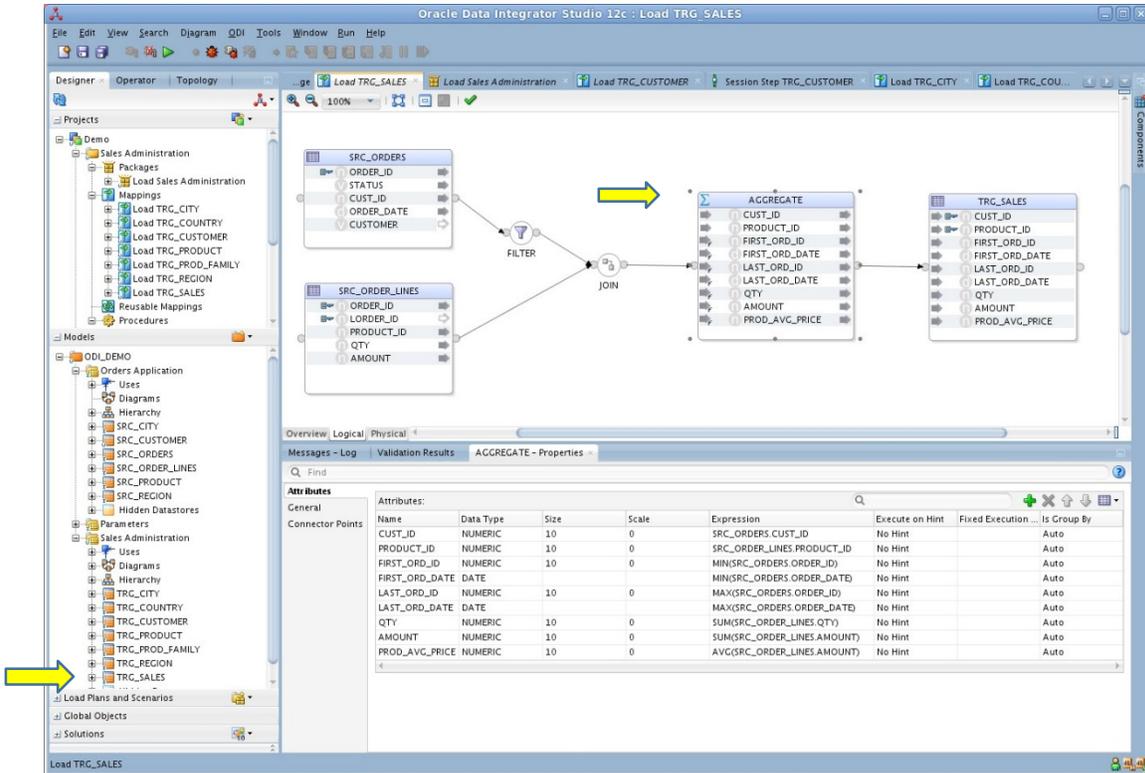
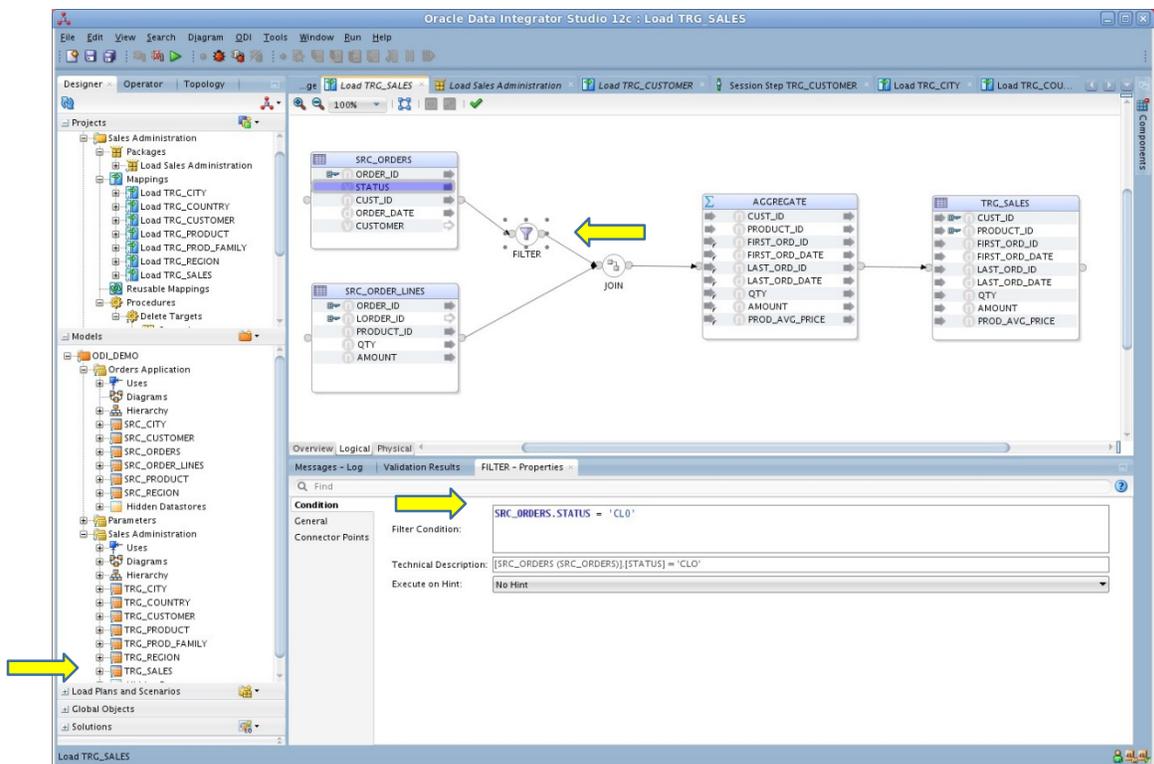


Figure 11. TRG\_SALES – Filter Focus



## **Sales Administration Intelligence System: Execution and Production**

### *Oracle Data Integrator Methodology*

BAU utilizes a development methodology based on the Oracle Data Integrator (ODI) tool. Oracle's website describes it this way. "A widely used data integration software product, Oracle Data Integrator provides a new declarative design approach to defining data transformation and integration processes, resulting in faster and simpler development and maintenance. Based on a unique *E-ET architecture (Extract - Load Transform)*, Oracle Data Integrator not only guarantees the highest level of performance possible for the execution of data transformation and validation processes ... Oracle Data Integrator provides a unified infrastructure to streamline data and application integration projects"<sup>1</sup>.

The ODI design, development, and implementation methodology is defined as:

- Create mappings to move and transform data
- Automate the execution of these mappings into scenarios (packages)
- Execute the scenario (package) and review the execution results
  - Package implementation in a production environment involves creating database jobs that automatically schedule job execution.
- Implement Data Quality Control to check data in a database environment
- Create a database job that implements a package execution schedule and provides process execution results.

### *Oracle Data Integrator Supervisor Account*

ODI is used to ingest data from multiple sources and transform and integrate the data into one unified data model for processing. As configured by BAU, the ODI *Supervisor* user account is the application/database account owner. The *Supervisor* account is used for design, development, testing, and production. BAU engineers use the *Supervisor* account to create a version control system on the Scenario package. After establishing version control, the BAU engineers use the *Supervisor* account to deploy the Scenario package into the production database by creating a database job that implements a job execution schedule. Enhancements and/or maintenance tasks are often performed on the production system by an available BAU staff using the Supervisor account.

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1. [https://docs.oracle.com/cd/E23943\\_01/integrate.1111/e12641/overview.htm#ODIGS111](https://docs.oracle.com/cd/E23943_01/integrate.1111/e12641/overview.htm#ODIGS111)

SAIS ETL Execution

The ETL process is described as a process scenario. The SAIS ETL process and execution results are represented in the following figures. The ODI tool executes the ETL by processing the scenario represented in the procedure mapping (see Figure 12). Detailed ETL execution results are provided by ODI as a means to control process integrity (see Figure 13). The SAIS ETL scenario begins with a procedure, Delete Targets, which deletes the current data from the target datastores. In this manner, the target datastores are refreshed with each ETL process scenario. The processing scenario proceeds to execute individual Mapping procedures to load the individual target datastores. ODI provides several interfaces to recognize ETL process results (see Figure 13, 14, & 15) and identifies processing errors for review and appropriate action (see Figure 15).

SAIS ETL Production

On successful completion of the SAIS ETL process scenario, the BAU engineer in charge of executing the process makes a log entry in the process journal to duly note the execution and status of the system. In cases where the ETL scenario fails the BAU performs appropriate corrective actions. The BAU engineer has the authority to re-execute the SAIS ETL scenario until the status of the process is deemed successful. In some cases, the BAU engineer alters the ETL production process code to achieve a successful execution. These cases are also noted in the process log journal.

Figure 12. SAIS ETL Process Scenario

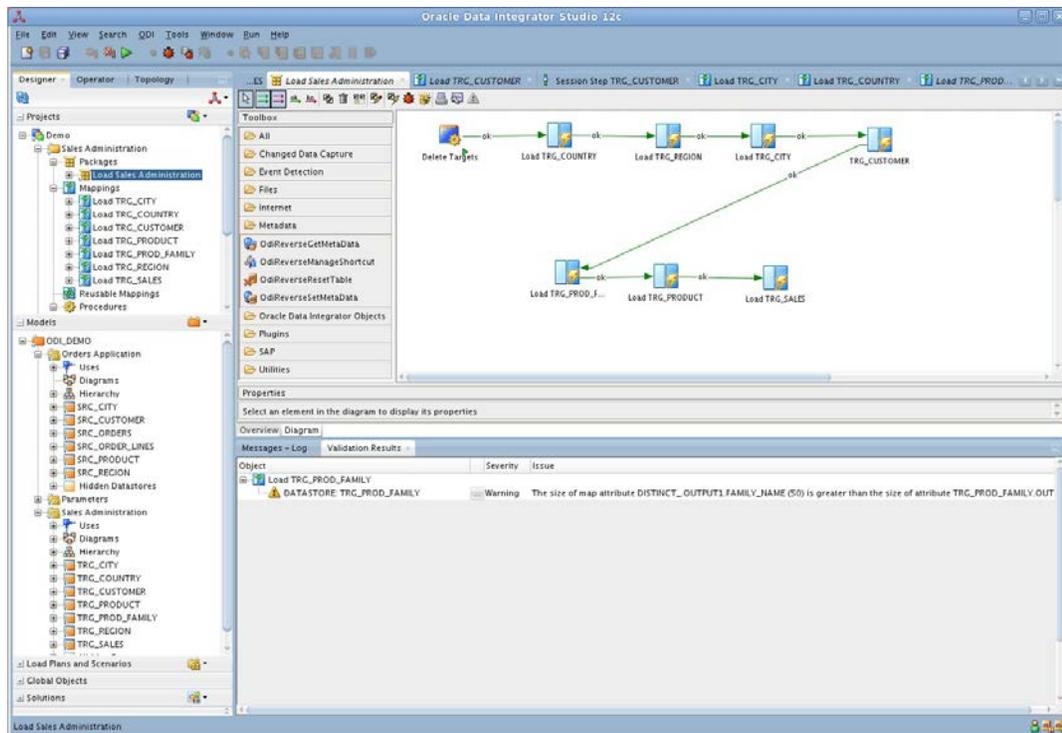


Figure 13. SAIS ETL Process Results

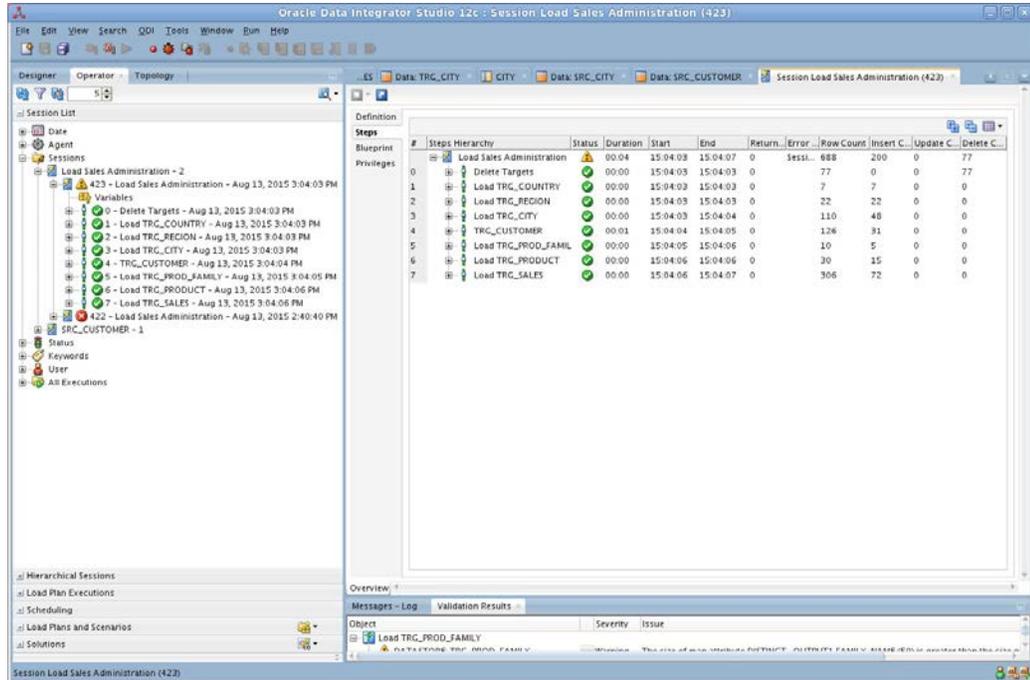


Figure 14. SAIS ETL Process: Session Results

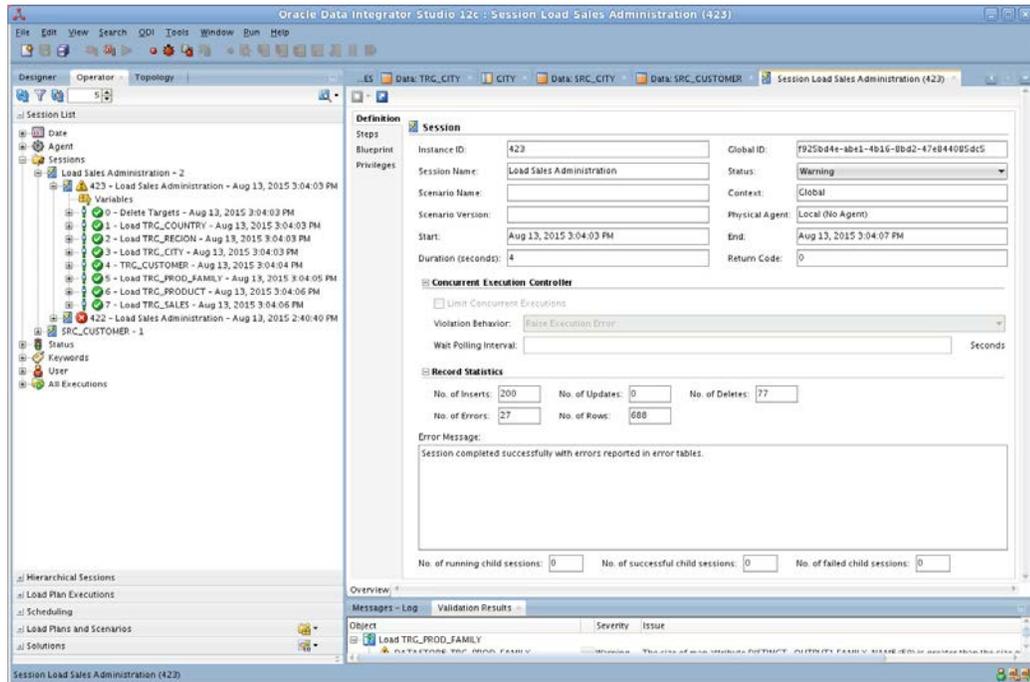
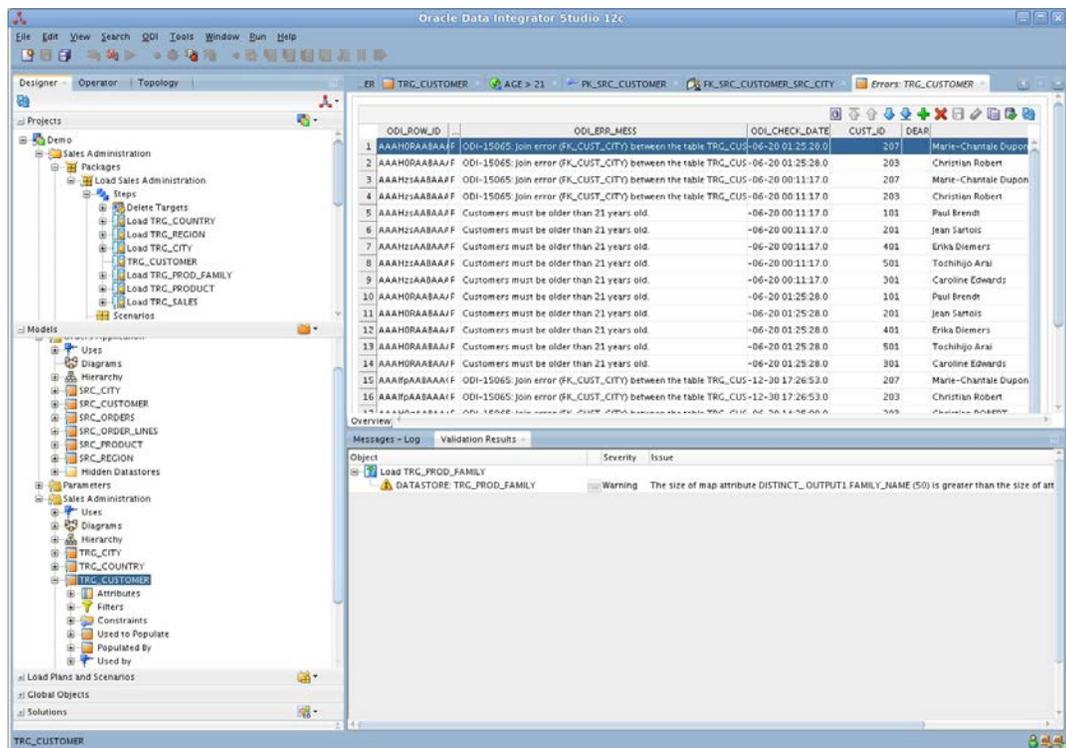


Figure 15. SAIS ETL Process: Errors



## **APPENDIX B**

### **Report on Internal Audit of New Systems Development Sales Administration Intelligence System (SAIS)**

**Purpose:** To perform an internal audit of the Sales Administration Intelligence System (SAIS) developed in-house by the Business Analytics Unit (BAU).

**Scope:** To assess the risks and internal controls implemented for SAIS that will ensure the system's processing integrity, system availability, security, and effective functioning in accordance with management's specifications.

**Background:** Company management requires an enterprise level intelligence system to assist management in making complex sales and marketing decisions as domestic and international competition increases. Management expects to use SAIS to monitor organization performance and to predict future sales and marketing opportunities. Also, management plans to use SAIS in determining incentive and performance compensation for executives and senior managers. SAIS is projected to be a comprehensive enterprise system that will extract, transform, and load (ETL) data into a repository supporting intelligence applications for subject areas related to Orders, Sales, Marketing and Logistics, and Product Support. Initially, SAIS will include order data from the Sales Department and sales person data from Human Resources Management (HRM). SAIS will extract this data from the database within the company's ERP system. Future SAIS enhancements will include services and data exchange with Marketing and Logistics, and Product Support, and the ability to incorporate large volumes of data (Big Data) from external sources such as industry and macroeconomic data sources.

The BAU has been designated as the organizational unit responsible for designing, developing and implementing the SAIS as a new addition to the company's production system. Staff in the BAU originated in the Sales Department and were recognized for providing management data for decision making within the department. The Accounting and Information Technology departments work indirectly with BAU, providing assurance and technical advice, but are not responsible for designing, developing or implementing the new system.

The development environment provides a visual process-oriented methodology to migrate, transform, and check the integrity of the data in SAIS. The BAU currently is integrating heterogeneous data sources using Oracle Data Integrator (ODI) Studio that is an off-the-shelf (OTS) system provided by Oracle Corporation that integrates data for big data applications. BAU plans to incorporate big data into SAIS in the future.

The challenges related to data integration and transformation include:

- Accurately and efficiently exchanging data between applications while respecting business rules of the respective system
- Automating end-to-end process flows
- Controlling and monitoring the entire set of data integration processes

The development process consists of:

- Creating mappings and data stores to move and transform data
- Automating the execution of these mappings into packages
- Preparing the developed components for deployment
- Implementing data quality control to check data in a database

SAIS is in development at this time. BAU expects to put the first version of SAIS into operations in the near future.

#### **Audit Findings**

1. **ISSUE:** SAIS has not been considered in the company's Strategic Long-Range (five-year) Plan or BAU's or the IT Department's Strategic Long-Range plans. Also, SAIS has not been considered in the company's Operational (one-year) Plan or BAU's or the IT Department's operational plans.
2. **ISSUE:** BAU has not developed a budget for implementing SAIS and is not tracking the costs of designing, developing or implementing SAIS. Management of the project appears to be informal with little or no documented milestones, timeframes, or cost tracking.
3. **ISSUE:** BAU is using Oracle Data Integrator (ODI) Studio that is an off-the-shelf (OTS) system provided by Oracle Corporation, but does not have a software license agreement for using the new software. Also, BAU is not installing Oracle software updates to OTS on a timely basis.

4. ISSUE: BAU will access files in the “Cloud” from outside the company’s internal network but has not addressed the network security risks caused by accessing these files from outside the company’s network demilitarized zone (DMZ)<sup>1</sup>. BAU has not considered how the DMZ, routers, and firewalls may need to be reconfigured to prevent unauthorized access from outside the company’s protected network. BAU has not considered monitoring firewall logs of denied access attempts.
5. ISSUE: The company’s documented Security Standards and Procedures have not been revised to include security for SAIS.
6. ISSUE: Assignment of user IDs and passwords for users of SAIS has not been addressed to control logical access to the SAIS system so that only authorized users can access the system. Also, BAU has not documented standards and procedures for authorizing and administering SAIS user IDs and passwords. For example, BAU has not established the requirement that all SAIS users must log on with a unique user ID and authenticate with their password each time a user accesses SAIS. The “Sales Administration Intelligence System, Extract, Transform, and Load (ETL) / Production Document” states on page 13 that the Oracle Data Integrator Supervisor Account “is used for design, development, testing, and production. BAU engineers use the Supervisor account to create a version control system on the Scenario package. After establishing version control, the BAU engineers use the Supervisor account to deploy the Scenario package into the production database by creating a database job that implements a job execution schedule. Enhancements and/or maintenance tasks are often performed on the production system by an available BAU staff using the Supervisor account.”
7. ISSUE: BAU has not documented or established Logical Segregation of Duties controls that would limit each SAIS user to just the screens and transactions that the user requires to perform his or her job function. As noted in finding 6 above, multiple users will be using the same Oracle Data Integrator Supervisor Account.
8. ISSUE: BAU has not determined what SAIS users’ access should be “read only” versus “read and update (delete)” or restricted SAIS users’ access in this manner.
9. ISSUE: SAIS has not set up a transaction history file that records each user’s access to SAIS and the activities performed by each user while logged on.
10. ISSUE: BAU has not considered the physical security of SAIS IT resources such as controlling physical access to the company’s network, hardware, and software devices that support the new system.
11. ISSUE: BAU has not established controls over physical or logical access to the Oracle Data Integrator (ODI) Studio. Also, BAU has not investigated to what extent if any that ODI records users’ accesses and activities in a systems log.
12. ISSUE: BAU has not documented a Change Management procedure for SAIS. There is no evidence that BAU will test SAIS in a test system before moving the tested system to the Production system. Also, there are no controls that will prevent BAU personnel from making unauthorized or improperly tested changes to SAIS once it is stored in the Production system.
13. ISSUE: BAU has not trained users on the new system, and has no documented training manuals for SAIS.
14. ISSUE: BAU has not documented or established backup and recovery procedures for backing up SAIS software and data and storing backup files at an offsite storage location.
15. ISSUE: Neither the company’s IT Disaster Recovery Plan nor the company’s Business Continuity Plan have been updated to include backup, recovery, and continuity procedures for SAIS in the event of a disaster.
16. ISSUE: There is a lack of controls to verify data transfer between systems. BAU has not documented how it will be confirmed that data is correctly transferred to SAIS.
17. ISSUE: There is a lack of data archiving for backup and restore given a failed process. As stated on page 13, “the BAU engineer has the authority to re-execute the SAI ETL scenario until the status of the process is deemed successful.” There is no indication of the determination of a successful completion, and during multiple iterations of the process scenario, data may be lost if it is not properly archived.
18. ISSUE: There is a general lack of Quality and Assurance testing by a non-development team. No provisions have been made to assess testing programs to include equivalence partitioning, boundary value analysis, and cause-effect graphing.

Conclusion: SAIS is an “end user” system developed and operated by BAU outside the IT General Controls established by the company’s IT Department. As such, the company must depend on BAU to provide internal controls for SAIS, even though BAU personnel are not IT professionals. We find that general computer controls for SAIS are inadequate and generally not established.

<sup>1</sup> For more information on DMZ in protecting entities’ networks, see <http://searchsecurity.techtarget.com/definition/DMZ> and [https://en.wikipedia.org/wiki/DMZ\\_\(computing\)](https://en.wikipedia.org/wiki/DMZ_(computing))



### **STATEMENT OF PEER REVIEW INTEGRITY**

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