Module (Integration)

Enterprise Application Integration and Migration

A Technology Briefing Module from

"e-Business and Distributed Systems Handbook "

Amjad Umar, Ph.D.
(www.amjadumar.com)
January 2003

MODULE (Integration): Enterprise Application Integration and Migration

Module Overview

Integration of enterprise applications has emerged as a critical issue for organizations in all business sectors striving to compete in a turbulent economy. Integration is the key to success because it makes information available to internal and external authorized users at an enterprise level. This Module addresses the crucial aspect of how new applications can be integrated with existing (including legacy) applications. It is of strategic importance to organizations to build new applications that harness the existing applications as seamlessly as possible -- the key driver for enterprise integration. The first chapter of this module establishes an overall framework for integration, including a discussion of legacy applications. A detailed discussion of application integration at enterprise and inter-enterprise levels can be found in the second chapter. Although integration is a natural choice, in many cases a data warehouse may avoid expensive integration efforts (Chapter 3). Finally, many legacy applications simply should not be integrated without a serious re-architecture and migration effort (Chapter 4). This Module complements the other two modules ("Applications" and "Architectures") shown in Figure 1. Collectively, these three modules address the main e-business application engineering and reengineering issues comprehensively.

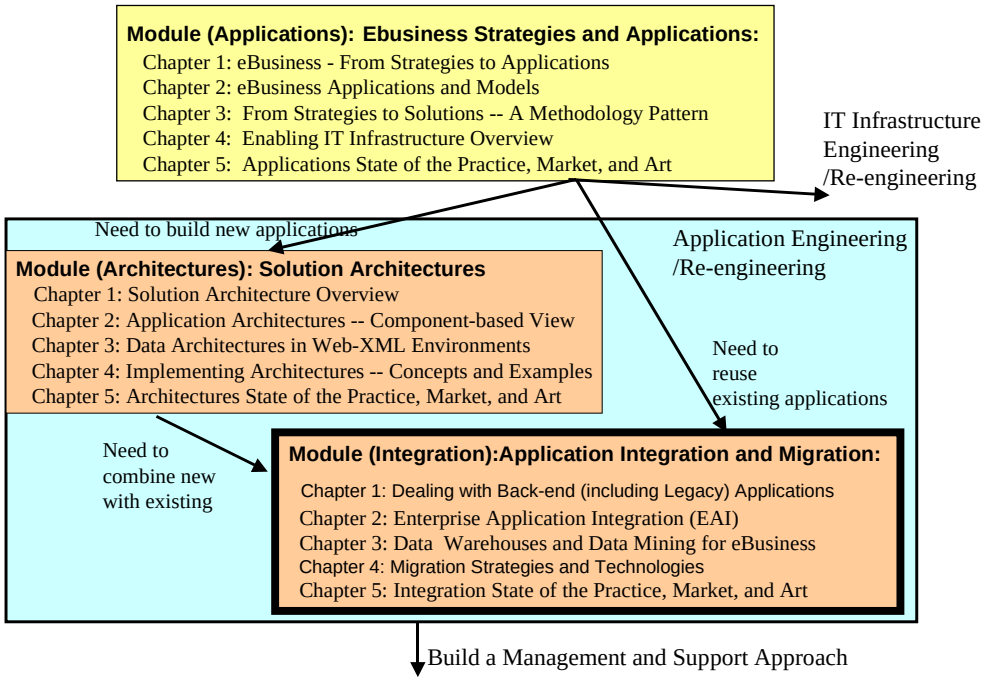

Figure 1: e-business Application Engineering and Reengineering

Module Case Studies

XYZCorp: Application Integration Task

The focus of the XYZCorp case study in this module is on the Application Integration and Migration Task (Figure 2). The focus of this task is determine how XYZCorp can integrate new applications with existing, including legacy, applications. Specifically, XYZCorp needs to develop a plan to integrate its business, engineering and manufacturing applications and needs to evaluate if these applications should be integrated "as-is" or restructured and migrated.

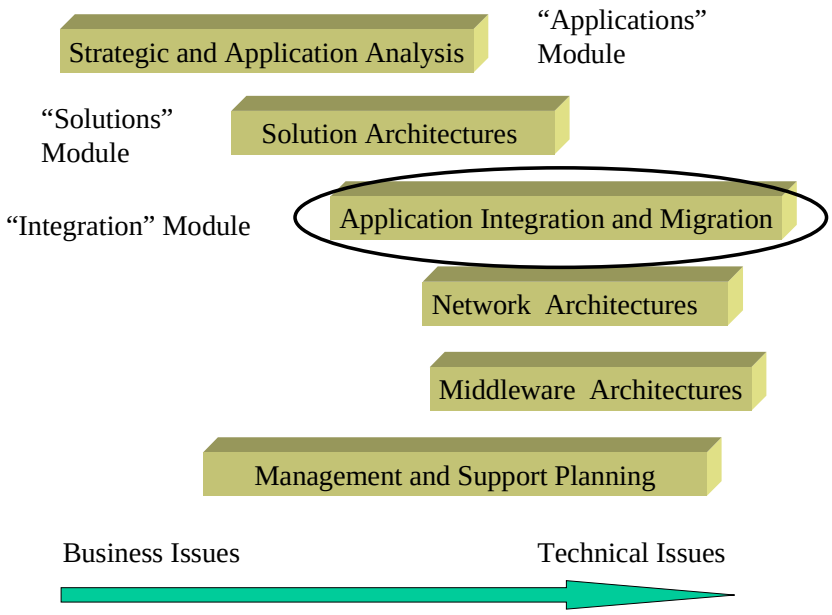

Figure 2: XYZCorp Planning Tasks

.

The Strategies and Applications Analysis Task has identified a wide range of new applications to meet the long and short range goals of the corporation. We considered, for example, five new applications in the "Architecture" Module. The Task also identified many existing, including legacy, applications that need to be integrated with the new applications. Examples of the existing, mostly legacy, applications are:

- A financial information system that processes financial data (e.g., personnel costs, materials costs, etc.) stored on the IBM mainframe in a DB2 Relational database.
- A mainframe-based corporate material requirement planning (MRP) system that contains bill of materials (raw materials) information in IMS databases and outside vendor information in DB2 databases
- Multiple mainframe and Unix based customer information systems that contain customer information in different market segments.
- A UNIX-based order processing system that was developed in the 1980s to receive orders, verify them, and send them to mainframe for shipping/receiving and billing purposes.

The following application (re)engineering projects have been initiated:

- An overall strategy and a plan to deal with the existing legacy applications. In particular, which strategy will be selected and why (i.e., ignore, access/integrate in place, data warehousing, gradual migration, or "cold turkey"). This project will be discussed at the end of Chapter 1 of this module.
- An approach to integrate the MRP application with the inventory management system. In particular, how will you access the mainframe databases (IMS and DB2) through Web. This project will be discussed at the end of Chapter 2 of this module.
- A data warehouse to help with customer information and the overall scope of this initiative. What steps will you take to develop a data warehouse and why? This project will be discussed at the end of Chapter 3 of this module.
- A detailed migration plan for the re-architecture and transition of the order processing application to an OCSI paradigm. What specific steps an tools/techniques will be employed in this migration? . This project will be discussed at the end of Chapter 4 of this module.

Additional Case Studies and Examples

Several additional case studies and examples are discussed in the chapters of this module. A number of case studies that are relevant to the topics discussed in this module appear regularly in trade magazines, vendor documents, Web sites and books. Chapter 5 of this module gives a sample of relevant case studies and points to numerous sources for additional case studies and examples..

In addition, the following case studies in the "Case Studies and Examples" Chapter of the "Overview" Module can be used to illustrate different aspects of the material in this module:

Section 2.4 Ecommerce - Online Purchasing Example. These examples can be easily extended to include integration problems. For example, how the various applications in the Electronic Store Front and B2B Purchasing can be integrated.

Section 2.5 A Financial Marketplace. After reviewing this case study, you can decide how the various applications can be integrated in this example? Can an eAI/EAI platform be used in this case? Which one and why?

Section 2.8 An Integrated Manufacturing System. This case study decsribes several applications that need to be integrated with each other. In particular, how the manufacturing applications (e.g., FMS, CAD/CAM) can be integrated with the business applications of inventory mamangement and order processing.

Section 2.9 A Customer Relationship Management Portal. Many technical choices are made in this case study. How can this CRM Portal be integrated with the partner systems such as internal systems such as the Can you use a super application server for this portal/ which one and why?

Module Contents -- High Level

1 INTEGRATION WITH EXISTING (INCLUDING LEGACY) APPLICATIONS -- AN OVERVIEW

1.1 INTRODUCTION
1.2 APPLICATION INTEGRATION: CONCEPTS AND DEFINITIONS
1.3 INTEGRATION OF ENTERPRISE APPLICATIONS -- GENERAL CONSIDERATIONS
1.4 APPLICATION INTEGRATION ARCHITECTURES - A QUICK LOOK
1.5 INTEGRATING WITH LEGACY APPLICATIONS -- A CLOSER LOOK
1.6 PLANNING FOR APPLICATION INTEGRATION
1.7 STATE OF THE PRACTICE: CASE STUDIES
1.8 STATE OF THE MARKET: REENGINEERING TOOLS
1.9 STATE OF THE ART: RESEARCH NOTES
1.10 SUMMARY
1.11 CASE STUDY: XYZCORP EMBARKS ON APPLICATION INTEGRATION AND MIGRATION
1.12 REVIEW QUESTIONS AND EXERCISES
1.13 ADDITIONAL INFORMATION

2 ENTERPRISE AND INTER-ENTERPRISE APPLICATION INTEGRATION (EAI/EAI)

2.1 INTRODUCTION
2.2 APPLICATION INTEGRATION CONCEPTS
2.3 AN INTEGRATION EXAMPLE
2.4 INTEGRATION TECHNOLOGIES AND ARCHITECTURES -- A CLOSER LOOK
2.5 B2B INTEGRATION -- A CLOSER LOOK
2.6 EAI PLATFORMS - A QUICK REVIEW
2.7 STATE OF THE PRACTICE: EXAMPLES OF E-BUSINESS APPLICATION INTEGRATION
2.8 A METHODOLOGY FOR APPLICATION INTEGRATION
2.9 SUMMARY
2.10 CASE STUDY: ACCESS/INTEGRATION FOR XYZCORP
2.11 PROBLEMS AND EXERCISES
2.12 REFERENCES

3 DATA WAREHOUSES AND DATA MINING -- AN INTEGRATION VIEW

3.1 INTRODUCTION
3.2 WHAT IS A DATA WAREHOUSE?
3.3 WHO USES THE DATA WAREHOUSE?
3.4 MOTIVATION FOR DATA WAREHOUSES
3.5 KEY CHARACTERISTICS OF A DATA WAREHOUSE
3.6 DATA WAREHOUSE ARCHITECTURES
3.7 DATA WAREHOUSE DESIGN ISSUES
3.8 TECHNOLOGIES FOR DATA WAREHOUSING
3.9 A PROCEDURE FOR DATA WAREHOUSE PLANNING AND DEVELOPMENT
3.10 MINING THE DATA WAREHOUSES
3.11 WEB MINING
3.12 STATE OF THE PRACTICE - CASE STUDIES AND EXAMPLES
3.13 STATE OF THE MARKET
3.14 STATE OF THE ART: RESEARCH AREAS
3.15 SUMMARY
3.16 CASE STUDY: DATA WAREHOUSE FOR XYZCORP
3.17 PROBLEMS AND EXERCISES
3.18 ADDITIONAL INFORMATION

4 MIGRATION STRATEGIES AND TECHNOLOGIES

4.1 INTRODUCTION
4.2 MIGRATION CONCEPTS AND STRATEGIES
4.3 USER INTERFACE MIGRATION TO WEB
4.4 DATA MIGRATION
4.5 COMPLETE APPLICATION MIGRATION
4.6 SYSTEM MIGRATION - MAINFRAME UNPLUGS
4.7 A PROCEDURE FOR MIGRATION
4.8 STATE OF THE PRACTICE: EXAMPLES AND CASE STUDIES
4.9 STATE OF THE MARKET: PRODUCTS
4.10 STATE OF THE ART: RESEARCH NOTES
4.11 SUMMARY
4.12 CASE STUDY: MIGRATION FOR XYZCORP
4.13 REVIEW QUESTIONS AND EXERCISES

4.14 ADDITIONAL INFORMATION

5 INTEGRATION STATE OF THE PRACTICE, MARKET, AND ART

5.1 INTRODUCTION
5.2 STATE OF THE PRACTICE- CASE STUDIES
5.3 STATE OF THE MARKET
5.4 STATE OF THE ART: TRENDS AND RESEARCH NOTES
5.5 EXERCISES

MODULE CONTENTS -- DETAILED

1 INTEGRATION WITH EXISTING (INCLUDING LEGACY) APPLICATIONS -- AN OVERVIEW

1.1 INTRODUCTION
1.2 APPLICATION INTEGRATION: CONCEPTS AND DEFINITIONS
1.2.1 What is Application Integration?
1.2.2 Why Integrate? Promises and Pitfalls
1.2.3 Application Integration – The Basic Models
1.2.4 A Broader Framework for integration
1.3 INTEGRATION OF ENTERPRISE APPLICATIONS -- GENERAL CONSIDERATIONS
1.3.1 Integration of Enterprise (Internal, Back-office) Applications
1.3.2 Integration of B2B Applications
1.3.3 Integration of Legacy Applications
1.4 APPLICATION INTEGRATION ARCHITECTURES - A QUICK LOOK
1.4.1 Overview
1.4.2 Application Integration Issues
1.4.3 Integrated Architectures by Using EAI (Enterprise Application Integration) Platforms)
1.5 INTEGRATING WITH LEGACY APPLICATIONS -- A CLOSER LOOK
1.5.1 Issues with Integrating Legacy Applications
1.5.2 Categories of Legacy Applications
1.5.3 Overview of Strategies to Integrate Legacy Applications
1.5.4 Strategy 1: Ignore the Legacy Applications
1.5.5 Strategy 2: Rewrite From Scratch (Cold Turkey)
1.5.6 Strategy 3: Access/Integration in Place
1.5.7 Strategy 4: Data Warehousing
1.5.8 Strategy 5: Gradual Migration
1.6 PLANNING FOR APPLICATION INTEGRATION
1.6.1 Overview
1.6.2 Opportunity Analysis
1.6.3 Choose a Solution Architecture
1.6.4 Implementation Considerations
1.6.5 Cost/benefit Analysis
1.6.6 Justification and Scheduling
1.7 STATE OF THE PRACTICE: CASE STUDIES
1.7.1 Short Examples of Application Integration
1.7.2 Off-Shore Reengineering of legacy Applications
1.7.3 Hewlett Packard's Migration to Client/Server Architecture
1.8 STATE OF THE MARKET: REENGINEERING TOOLS
1.9 STATE OF THE ART: RESEARCH NOTES
1.10 SUMMARY

1.11 CASE STUDY: XYZCORP EMBARKS ON APPLICATION INTEGRATION AND MIGRATION
1.11.1 Overall Integration Strategy Project
1.11.2 Hints About The Case Study
1.12 REVIEW QUESTIONS AND EXERCISES
1.13 ADDITIONAL INFORMATION

2 ENTERPRISE AND INTER-ENTERPRISE APPLICATION INTEGRATION (EAI/EAI)

2.1 INTRODUCTION
2.2 APPLICATION INTEGRATION CONCEPTS
2.2.1 Application Integration - Revisited
2.2.2 Categories of Applications - An Integrator's View
2.2.3 Integration Technologies Overview
2.2.4 EAI versus eAI -- Big "E" versus Little "e"
2.3 AN INTEGRATION EXAMPLE
2.4 INTEGRATION TECHNOLOGIES AND ARCHITECTURES -- A CLOSER LOOK
2.4.1 Overview
2.4.2 Application Connectivity: Types of Connection for eAI Lite
2.4.3 Application Connectivity: Connectivity Models for eAI Lite
2.4.4 Information Transformation - eAI Mid
2.4.5 Process and Workflow Management -- eAI Heavy
2.4.6 B2B Process Management – eAI Superheavy
2.5 B2B INTEGRATION -- A CLOSER LOOK
2.5.1 B2B Integration for B2B e-Commerce
2.5.2 B2B Integration Solution Components
2.5.3 B2B Integration Summary
2.6 EAI PLATFORMS - A QUICK REVIEW
2.6.1 Overview
2.6.2 eAI Platform for Enterprise applications -- State of the Market
2.6.3 B2B Application Integration Platforms – State of the Market
2.7 STATE OF THE PRACTICE: EXAMPLES OF EBUSINESS APPLICATION INTEGRATION
2.7.1 Overview
2.7.2 Example 1: EAI-Lite -- Integrating a Few "Friendly" Applications
2.7.3 Example 2: eAI Mid -- Integrating Few 'Hostile" (Legacy) Applications
2.7.4 Example 3: eAI Heavy -- Enterprise Application Integration
2.7.5 Example 4: eAI SuperHeavy -- Application Integration in Trading Networks
2.8 A METHODOLOGY FOR APPLICATION INTEGRATION
2.8.1 Step 1: Integration Requirements and Logical Models
2.8.2 Step 2: Develop Solution Architectures
2.8.3 Step 3: Implement, Deploy, and Support
2.8.4 Step 4: Deploy and Support
2.9 SUMMARY
2.10 CASE STUDY: ACCESS/INTEGRATION FOR XYZCORP
2.10.1 Hints About The Case Study
2.11 PROBLEMS AND EXERCISES
2.12 REFERENCES

3 DATA WAREHOUSES AND DATA MINING FOR INTEGRATION

3.1 INTRODUCTION
3.2 WHAT IS A DATA WAREHOUSE?
3.2.1 Overview
3.2.2 Definitions
3.2.3 Examples
3.3 WHO USES THE DATA WAREHOUSE?
3.4 MOTIVATION FOR DATA WAREHOUSES

3.4.1 Why Data Warehouses?
3.4.2 Promises and Pitfalls of Data Warehouses
3.5 KEY CHARACTERISTICS OF A DATA WAREHOUSE
3.5.1 Data Characteristics
3.5.2 Tool Characteristics
3.6 DATA WAREHOUSE ARCHITECTURES
3.6.1 Localized Functional Warehouses ("The Data Marts")
3.6.2 Centralized Data Warehouse
3.6.3 Distributed Data Warehouses ("The Virtual Warehouse")
3.6.4 Operational Data Warehouses
3.7 DATA WAREHOUSE DESIGN ISSUES
3.7.1 Granularity
3.7.2 Partitioning (Fragmentation)
3.7.3 Data Structures
3.7.4 Quality of Data Warehouse
3.8 TECHNOLOGIES FOR DATA WAREHOUSING
3.8.1 Data Extraction and Loading Software
3.8.2 Multidimensional Databases and Database Engines
3.8.3 Meta Data Software
3.8.4 Tools for Data Warehouse Access and Manipulation
3.8.5 Warehouses and the Web: A Good Marriage or a Meaningless Relationship?
3.8.6 10.8.5 Middleware To Access the Data Warehouse
3.9 A PROCEDURE FOR DATA WAREHOUSE PLANNING AND DEVELOPMENT
3.9.1 10.9.1 Overview
3.9.2 10.9.2 Step 1: Management Planning
3.9.3 Step 2: Requirements Gathering
3.9.4 Step 3: Data Modeling
3.9.5 Step 4: Design and Implementation
3.9.6 Step 5: Deployment and Administration
3.10 MINING THE DATA WAREHOUSES
3.10.1 Overview
3.10.2 Data Mining Examples
3.10.3 Issues with Data Mining
3.10.4 Data Mining Algorithms
3.10.5 Data Mining Process and Data Mining Standards
3.11 WEB MINING
3.11.1 Overview
3.11.2 Clickstreams and Cookies
3.11.3 Events of Interest for Mining
3.11.4 Web Mining Vendors
3.12 STATE OF THE PRACTICE - CASE STUDIES AND EXAMPLES
3.12.1 IBM Shifts To Data Marts
3.12.2 Relia Star Financial Data Warehouse For Competitive Advantage
3.12.3 3Com's Data Warehouse
3.12.4 British Telecom's Data Warehouse
3.12.5 Banc One's Transition to Data Warehousing
3.12.6 Short Case Studies ("Snippets")
3.13 STATE OF THE MARKET
3.14 STATE OF THE ART: RESEARCH AREAS
3.15 SUMMARY
3.16 CASE STUDY: DATA WAREHOUSE FOR XYZCORP
3.17 ADDITIONAL INFORMATION

4 MIGRATION STRATEGIES AND TECHNOLOGIES

4.1 INTRODUCTION
4.2 MIGRATION CONCEPTS AND STRATEGIES
4.2.1 When to Migrate and When Not To
4.2.2 Minimizing Migrations -- The Model Driven Architecture
4.2.3 Approaches for Migration
4.3 USER INTERFACE MIGRATION TO WEB
4.4 DATA MIGRATION
4.4.1 Overview
4.4.2 A Framework for Discussing Data Migration
4.4.3 Data Migration Technologies
4.5 COMPLETE APPLICATION MIGRATION -- REPLACING SYSTEMS WITH ERPS
4.5.1 Overview
4.5.2 Highly Structured (Decomposable) Application Migration
4.5.3 Semi-Decomposable (Program Decomposable) Applications
4.5.4 Unstructured (Monolithic) Applications.
4.5.5 Migration Gateways - Technologies for Migration
4.6 SYSTEM MIGRATION - MAINFRAME UNPLUGS
4.6.1 System Migration Concepts
4.7 A PROCEDURE FOR MIGRATION
4.7.1 Step 1: Business Analysis and Migration Planning
4.7.2 Step 2: Develop and Justify a Migration Architecture
4.7.3 Step 3: Implementation
4.7.4 Step 4: Deployment and Support Considerations
4.8 STATE OF THE PRACTICE: EXAMPLES AND CASE STUDIES
4.8.1 Short Case Studies (including "Oldies but Goodies")
4.8.2 A Detailed Example: Migration of a Project Management System
4.9 STATE OF THE MARKET: PRODUCTS
4.10 STATE OF THE ART: RESEARCH NOTES
4.11 SUMMARY
4.12 CASE STUDY: MIGRATION FOR XYZCORP
4.13 REVIEW QUESTIONS AND EXERCISES
4.14 ADDITIONAL INFORMATION

5 INTEGRATION STATE OF THE PRACTICE, MARKET, AND ART

5.1 INTRODUCTION
5.2 STATE OF THE PRACTICE -- CASE STUDIES
5.2.1 Commonwealth Bank and Colonial Limited Merger
5.2.2 Owens-Corning Deploys ERPs for Integration
5.2.3 Deutsche Bank Uses Vitria eAI Platform
5.2.4 Telia Uses TIBCO eAI Platform
5.2.5 U.S. Army Supports Blackhawk Helicopters with webMethods eAI
5.2.6 Real-Time Business Activity Monitoring for Real-Time Enterprises -- Snippets
5.2.7 Host integration -- Hewitt Associates LLC
5.2.8 XML Connector Integrates XML Data with the Enterprise
5.2.9 Mobility for Ontario Government -- Integration of Wireless Services
5.2.10 Conversion of an Asset Management Program
5.2.11 VOLKSWAGEN Group Japan Enhances Dealer Rrelations with IBM Solution
5.2.12 Banc One's Transition to Data Warehousing
5.2.13 BlueCross BlueShield of Tennessee Does Strategic Business Process Integration
5.2.14 UK's Clear Makes One-Stop Online Bill Payment a Reality
5.2.15 Credit Lyonnais Streamlines Capital Market Operations
5.3 STATE OF THE MARKET
5.3.1 Integration Platforms State of the Market
5.3.2 Data Warehouses and Data Mining State of the Market

5.3.3 Migration State of the Market
5.4 STATE OF THE ART: TRENDS AND RESEARCH NOTES
5.4.1 General Trends
5.4.2 Integration for Real-time Enterprises -- A Note
5.5 EXERCISES