

Module (Platforms)

Platforms for Mobile and EC/EB Applications

<p><u>e-Business Applications, Architectures, Integration</u></p> <p>MODULE (APPLICATIONS): e-Business Strategies and Applications: Chapter 1: e-Business - From Strategies to Applications Chapter 2: e-Business Applications (CRMs, ERPs, eMarkets, SCM, ASPs, Portals) Chapter 3: From Strategies to Solutions -- A Planning Methodology Chapter 4: IT Infrastructure -- Overview of Enabling Technologies Chapter 5: Applications State of the Practice, Market, and Art</p> <p>MODULE (ARCHITECTURES): Solution Architectures Through Components Chapter 1: Solution Architecture Overview Chapter 2: Enterprise Application Architectures -- Component-based Approach Chapter 3: Enterprise Data Architectures in Web-XML Environments Chapter 4: Implementing Architectures -- Concepts and Examples Chapter 5: Architectures State of the Practice, Market, and Art</p> <p>MODULE (INTEGRATION): Enterprise Application Integration and Migration Chapter 1: Integration with Existing (Including Legacy) Applications -- An Overview Chapter 2: Enterprise and Inter-Enterprise Application Integration (EAI/eAI) Chapter 3: Data Warehouses and Data Mining for Integration Chapter 4: Migration Strategies and Technologies Chapter 5: Integration State of the Practice, Market, and Art</p>	<p><u>Background and Management</u></p> <p>MODULE (OVERVIEW); The Big Picture Chapter 1: e-Business and 3G Distributed Systems --From Strategies to Working Solutions</p> <p>MODULE (EXAMPLES); Case Studies & Examples Chapter 2: Case Studies and Examples</p> <p>MODULE (MANAGEMENT): Management and Security Chapter 1 e-Business Management in Practice Chapter 2: Management Platforms for Network and Systems Management Chapter 3: Security Management - Approaches and Technologies Chapter 4: Security Solutions -- Using Technologies to Secure Systems Chapter 5: Management State of the Practice, Market, and Art</p> <p>MODULE (TUTORIALS): Tutorials and Detailed Discussions on Special Topics Chapter 1: Network Technologies -- A Tutorial Chapter 2: Object-Oriented, Java, and UML -- A Tutorial Chapter 3: Database Technologies and SQL -- A Tutorial Chapter 4: Web Engineering and XML Processing -- A Closer Look Chapter 5: CORBA -- A Closer Look</p>
<p><u>The Enabling IT Infrastructure</u></p> <p>MODULE (PLATFORMS): Platforms for Mobile and EC/EB Applications Chapter 1: Mobile Computing Platforms -- Mobile Application Servers Chapter 2: e-Commerce Platforms for C2B Trade-- The Commerce Servers Chapter 3: B2B Platforms and Standards -- The B2B Servers Chapter 4: Platforms for Multimedia and Collaboration Chapter 5: Platforms State of the Practice, Market, and Art</p> <p>MODULE (MIDDLEWARE) - Application Connectivity through Middleware Chapter 1: Middleware Principles and Basic Middleware Services Chapter 2: Web, XML, Semantic Web, and Web Services Chapter 3: Distributed Objects: CORBA, J2EE, .NET, SOAP, and EJBs Chapter 4: Enterprise Data and Transaction Management Chapter 5: Middleware State of the Practice, Market, and Art</p> <p>MODULE (NETWORKS): Network Services and Network Architectures Chapter 1: Principles of Communication Networks Chapter 2: Network Architectures and Interconnectivity Chapter 3: Wireless and Broadband Networks -- Next Generation Networks: Chapter 4: IP-based Networks and the Next Generation Internet Chapter 5: Networks State of the Practice, Market, and Art</p>	

A Technology Briefing Module from

"e-Business and Distributing Systems Handbook"

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

January 2003

MODULE (Platforms): Platforms for Mobile and EC/EB Applications

Module Overview

Middleware services are growing at a rapid rate to support a wide range of current and future applications. In the "Middleware" Module, we discussed the general purpose middleware services such as Web, CORBA, XML/SOAP, and distributed transaction processing that can support almost any type of application. In this module, we turn our attention to the higher level and specialized middleware services that are becoming available to support specialized applications such as mobile computing, ecommerce/ebusiness, and realtime systems (see Figure 1 - our focus is on the block with dark borders). Many of these special purpose middleware services, shown with a dark border in the following diagram, are also being packaged with other infrastructure services to form "**Application Servers**", also known as "**Middleware Platforms**". Examples of these platforms are Mobile Application Servers based on WAP (Wireless Application Protocol), eCommerce Platforms such as IBM's Websphere, and eBusiness Platforms for B2B trade such as Vitria's Businessware.

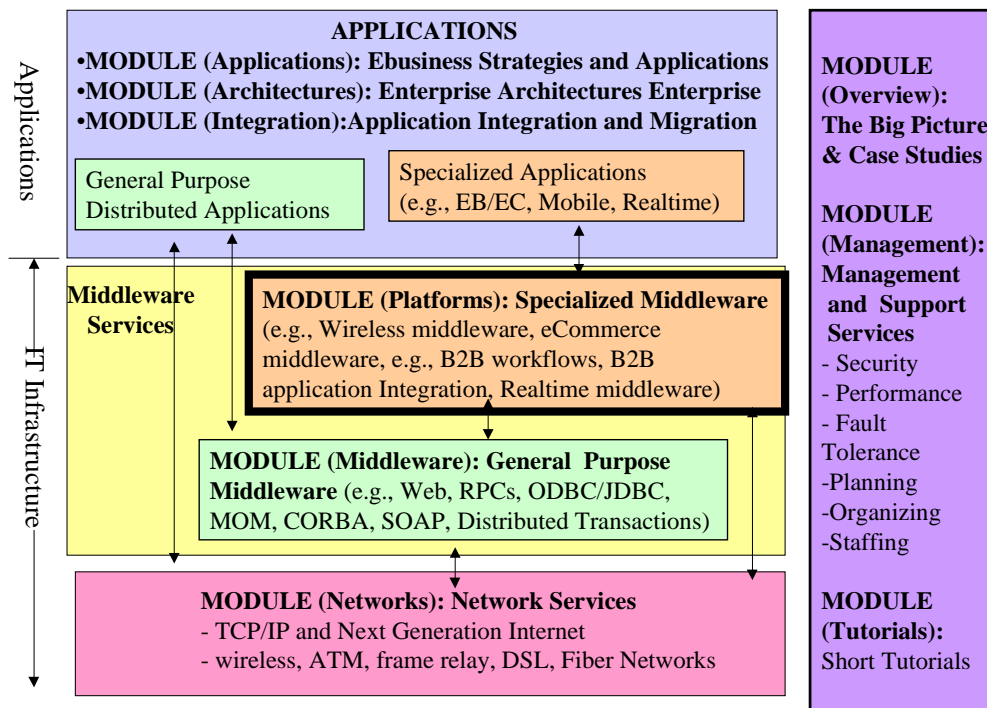


Figure 1: Specialized and Higher Level Middleware Services

This trend of application servers/middleware platforms is significant because now you can buy a complete suite of technologies that work together to solve specific business problems. It is easier and cheaper to build ecommerce applications by using ecommerce platforms and build mobile applications by using mobile application servers. The following chapters of this module discuss these application servers/middleware platforms in some detail.

Chapter 1: Mobile Computing Platforms -- The Mobile Application Servers

Chapter 2: ECommerce Platforms for C2B Trade -- The Commerce Servers

Chapter 3: B2B Platforms and Standards -- The B2B Servers

Chapter 4: Platforms for Multimedia and Collaboration

Chapter 5: Application Server State of the Practice, Market, and Art

These chapters in essence discuss Application Servers and their variants (Mobile Application Servers, Commerce Servers, B2B Servers, and Collaboration Servers). Simply stated, an **Application Server** (also known as app server) is a platform for development, deployment, and management/support of Web-based applications. Let us take a quick look at the application servers and its variants. At present, application servers exist in the following classes:

- General purpose application servers
- Special purpose app servers developed to support, for example, mobile applications and ecommerce applications.

General Application Servers, or just application servers, package several technologies (network support, middleware services, software development environments, and monitoring/control systems) to build, deploy and manage modern Web-based applications. The current and future versions of general application servers include facilities for development, deployment, and management of web-XML applications. This includes facilities for EJB (Enterprise Java Bean) component development, XML exchanges, load balancing, failure handling, and adapters for connecting to back-end applications. Sun is positioning its J2EE and Microsoft is positioning its .NET platform as application servers. A well known application server is the BEA Weblogic Server. We will discuss the general application servers in Chapter 5.

Mobile Application Servers, discussed in Chapter 1, are application servers that package several technologies (wireless network support, wireless middleware services, wireless software development environments, and wireless monitoring/control systems) to build, deploy and manage mobile applications. Nokia's WAP Server, Oracle's Mobile Application Server, and Agilo's Server IBM's Web are examples of mobile application servers.

Commerce Servers, discussed in Chapter 2, are application servers that package several technologies (network support, EC middleware services, EC software development environments, and EC monitoring/control systems) to build, deploy and manage EC applications. These servers are also known as ecommerce servers. Microsoft's Commerce Server, Sun's Iplanet, and ecommerce platforms from Open Market are examples.

B2B Servers, discussed in Chapter 3, are application servers that package several technologies (B2B network support, B2B middleware services, B2B software development environments, and B2B monitoring/control systems) to build, deploy and manage B2B applications. Vitiria's BusinessWare, Active's ActiveWare and HP's e-Speak are examples.

Collabortation servers, discussed in Chapter 4, are application servers that package several technologies to build, deploy and manage collaborative applications. Lotus Notes is an example of collaboration servers.

Naturally, you can envision "**Super Application Servers**" that combine all the services needed for web, mobile applications, and EC/EB services on a single platform. That is exactly what has happened. IBM's WebSphere is an example. Another interesting example is the Netscape Application Server that

combines web development capabilities with enterprise applications to integrate with corporate data sources. These "Super Application Servers" are discussed in Chapter 5 along with a discussion of state of the practice (case studies) and state of the market (commercial products).

Reader Background Expected

This Module builds upon the discussion of middleware services contained in the Middleware Module. Thus the Middleware Module is a necessary prerequisite. In addition, the information contained in the Applications Module is highly recommended as a prerequisite because it describes the EC/EB applications that the middleware platforms support.

Module Case Studies

XYZCorp Case Study: Middleware Platforms Architecture

The focus of the XYZCorp case study in this module is on Middleware Platforms Architectures (see Figure 2). This task goes beyond the basic middleware architecture developed in the "Middleware" Module and highlights the role of commercially available platforms that package several technologies together. In particular, the company wants to evaluate COTS (Commercial-Off-The-Shelf) platforms that could support mobility and B2B as well as C2B trade. It is important that these platforms interwork with other middleware services that were established in the XYZCorp "middleware architecture" in the "Middleware" Module. We will develop this architecture by working through the following projects that will be completed in this and later chapters in this module:

- A mobility project that will support a variety of mobility services for its employees and customers in the next few years. See Chapter 2 of this module
- An ecommerce project that will setup an online purchasing system for customers to purchase the company products through the Web. See Chapter 2 of this module
- A B2B project for business partners and suppliers to interact with each other through direct interactions and/or emarkets. See Chapter 3 of this module.
- A next generation middleware project that will support futuristic groupware, multimedia applications, and enterprise-wide distributed applications. See Chapter 4 of this module.

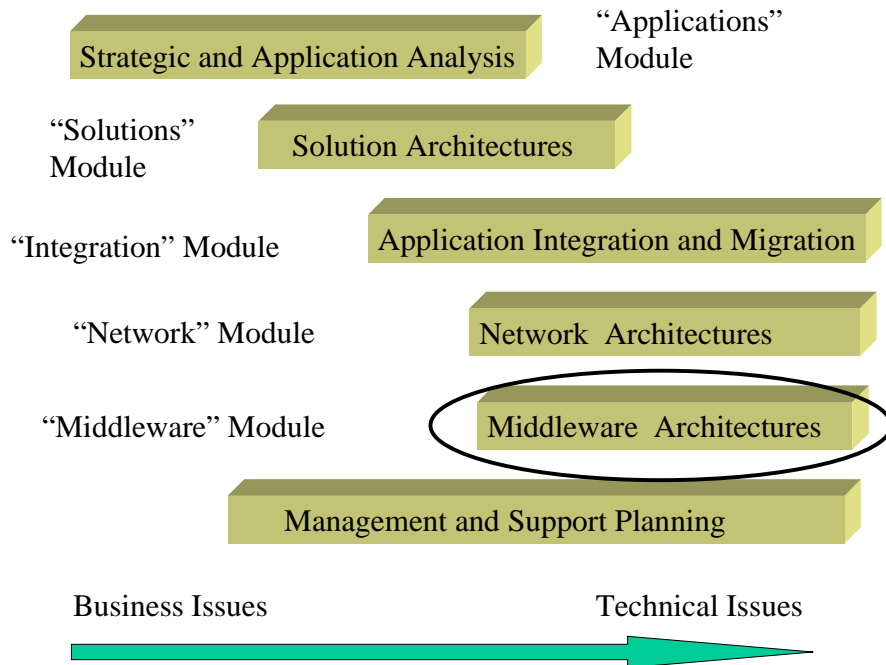


Figure 2: XYZCorp Planning Tasks

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 2.3 Ecommerce/eBusiness Examples:.. These examples can be used to understand how technical choices were made some time ago and to analyze how different application servers could be used for the cases

Section 2.5 A Financial Marketplace. After reviewing this case study, you can choose a B2B server for this marketplace

Section 2.6 City of Seattle Public Utilities Go Wireless. This case study shows how the decisions were made in 1999. How would you do it today?

Section 2.9 A Customer Relationship Management Portal. Many technical choices are made in this case study. Can you use a super application server for this portal/ which one and why?

MODULE CONTENTS -- HIGH LEVEL

1 MOBILE COMPUTING PLATFORMS -- THE MOBILE APPLICATION SERVERS

- 1.1 INTRODUCTION
- 1.2 MOBILE APPLICATIONS AND MOBILE COMMERCE -- OVERVIEW AND EXAMPLES
- 1.3 WIRELESS NETWORKS -- A QUICK OVERVIEW
- 1.4 CASE STUDIES AND EXAMPLES OF MOBILITY
- 1.5 MOBILE APPLICATION SERVERS -- CONCEPTS AND EXAMPLES
- 1.6 THE WIRELESS APPLICATION PROTOCOL (WAP)
- 1.7 OTHER MIDDLEWARE FOR WIRELESS (I-MODE, WIRELESS JAVA, BREW)
- 1.8 VOICE COMMUNICATIONS -- VOICE BROWSERS AND VOICE XML
- 1.9 MOBILE AGENTS
- 1.10 CHAPTER SUMMARY
- 1.11 CASE STUDY: XYZCORP INVESTIGATES PLATFORMS FOR MOBILITY AND EC/EB SERVICES
- 1.12 REVIEW QUESTIONS AND EXERCISES
- 1.13 ADDITIONAL INFORMATION

2 E-COMMERCE PLATFORMS FOR C2B TRADE -- THE COMMERCE SERVERS

- 2.1 INTRODUCTION
- 2.2 INTERNET-BASED PURCHASING OVERVIEW
- 2.3 C2B ECOMMERCE MIDDLEWARE
- 2.4 SECURITY FOR ECOMMERCE/EBUSINESS
- 2.5 ELECTRONIC COMMERCE PLATFORMS: PACKAGING EC MIDDLEWARE
- 2.6 OUTSOURCING CONSIDERATIONS
- 2.7 CONCLUDING COMMENTS
- 2.8 CASE STUDY: ON-LINE PURCHASING FOR XYZCORP
- 2.9 REVIEW QUESTIONS AND EXERCISES
- 2.10 ADDITIONAL INFORMATION

3 B2B PLATFORMS AND STANDARDS -- THE B2B SERVERS

- 3.1 INTRODUCTION
- 3.2 B2B DIRECT INTERACTIONS (SUPPLY CHAINS) -- ANOTHER LOOK
- 3.3 B2B THROUGH INTERMEDIARIES -- ANOTHER LOOK
- 3.4 MIDDLEWARE TECHNOLOGIES TO SUPPORT B2B COMMERCE - A QUICK OVERVIEW
- 3.5 B2B MESSAGE EXCHANGES BETWEEN PARTNERS -- EDI AND XML
- 3.6 B2B MIDDLEWARE NEEDED TO SUPPORT eMARKETS
- 3.7 B2B EXCHANGES STANDARDS (EBXML, PIPs) -- EFFORTS TOWARDS INTEROPERABILITY
- 3.8 WORKFLOW MANAGEMENT
- 3.9 ENTERPRISE APPLICATION INTEGRATION (EAI) PLATFORMS
- 3.10 EXAMPLES OF B2B PLATFORMS -- THE B2B SERVERS
- 3.11 CONCLUDING COMMENTS
- 3.12 CASE STUDY: XYZCORP B2B SERVICES AND PLATFORMS
- 3.13 REVIEW QUESTIONS AND EXERCISES
- 3.14 CHAPTER REFERENCES

4 PLATFORMS FOR MULTIMEDIA AND COLLABORATION

- 4.1 INTRODUCTION
- 4.2 PLATFORMS FOR DISTRIBUTED MULTIMEDIA APPLICATIONS
- 4.3 GROUPWARE AND COLLABORATION SERVERS
- 4.4 DISTRIBUTED OPERATING SYSTEMS
- 4.5 APPLICATION SERVERS -- EVOLUTION OF PACKAGING MIDDLEWARE SERVICES
- 4.6 THE NEXT GENERATION MIDDLEWARE
- 4.7 SUMMARY
- 4.8 CASE STUDY: XYZCORP INVESTIGATES EMERGING MIDDLEWARE SERVICES AND PLATFORMS
- 4.9 PROBLEMS AND EXERCISES
- 4.10 ADDITIONAL INFORMATION

5 APPLICATION SERVERS STATE OF THE PRACTICE, MARKET, AND ART

- 5.1 INTRODUCTION
- 5.2 APPLICATION SERVERS -- STATE OF THE PRACTICE CASE STUDIES
- 5.3 STATE OF THE MARKET -- COMMERCIAL APPLICATION SERVERS
- 5.4 STATE OF THE ART -- APPLICATION SERVER EVOLUTION AND TRENDS
- 5.5 EXERCISES

MODULE CONTENTS -- DETAILED

1 MOBILE APPLICATION SERVERS

- 1.1 INTRODUCTION
 - 1.1.1 *A Framework for Discussing Mobility*
- 1.2 MOBILE APPLICATIONS AND MOBILE COMMERCE -- OVERVIEW AND EXAMPLES
 - 1.2.1 *Mobile Enterprise Business Applications (MEBAs).*
 - 1.2.2 *Mobile Commerce (M-Commerce)*
 - 1.2.3 *Voice Commerce (V-Commerce), Positional Commerce (p-commerce) and TV-Commerce (T-Commerce)*
- 1.3 WIRELESS NETWORKS -- A QUICK OVERVIEW
 - 1.3.1 *Wireless WANs - the Cellular and Cordless Networks*
 - 1.3.2 *Evolution of Cellular Networks -- The 3G Networks*
 - 1.3.3 *Wireless LANs: IEEE802.11 and Bluetooth*
 - 1.3.4 *Summary of Wireless Networks*
- 1.4 CASE STUDIES AND EXAMPLES OF MOBILITY
 - 1.4.1 *Overview*
 - 1.4.2 *Airline Industries*
 - 1.4.3 *Financial Industry*
 - 1.4.4 *Car Rental Agencies*
 - 1.4.5 *Healthcare*
 - 1.4.6 *Retail Industries for Online Purchasing*
- 1.5 MOBILE APPLICATION SERVERS -- CONCEPTS AND EXAMPLES
 - 1.5.1 *Overview*
 - 1.5.2 *Conceptual Model of Mobile Application Servers*
 - 1.5.3 *Examples of Mobile Application Servers*
- 1.6 THE WIRELESS APPLICATION PROTOCOL (WAP)
 - 1.6.1 *Overview*
 - 1.6.2 *Why WAP is Needed?*
 - 1.6.3 *The New WAP -- WAP 2.0*
 - 1.6.4 *Wireless Application Environment (WAE)*
 - 1.6.5 *Wireless Markup Language (WML)*
 - 1.6.6 *WAP Microbrowsers*
 - 1.6.7 *WAP Gateway*
 - 1.6.8 *WAP Security*
 - 1.6.9 *WAP Applications*
 - 1.6.10 *Example of WAP and Bluetooth Together*
 - 1.6.11 *WAP Summary and Trends*
- 1.7 OTHER MIDDLEWARE FOR WIRELESS (I-MODE, WIRELESS JAVA, BREW)
 - 1.7.1 *Overview*
 - 1.7.2 *i-Mode*
 - 1.7.3 *Wireless Java and J2ME (Java 2 Micro Edition)*
 - 1.7.4 *QualComm's Binary Runtime Environment for Wireless (BREW)*
 - 1.7.5 *Message Oriented Middleware for Mobility*
- 1.8 VOICE COMMUNICATIONS -- VOICE BROWSERS AND VOICE XML
 - 1.8.1 *Overview*
 - 1.8.2 *Voice Browsers*
 - 1.8.3 *VOICE XML*
- 1.9 MOBILE AGENTS
 - 1.9.1 *Overview: What are Agents, Intelligent Agents, and Mobile Agents*
 - 1.9.2 *Mobile Agents Versus Client/Server Model*
 - 1.9.3 *Sample Applications of Mobile Agents in Ecommerce*
 - 1.9.4 *Mobile Agent Requirements*

- 1.9.5 *Existing Mobile Agent Platforms and Architectures*
- 1.9.6 *Mobile Agent Summary*
- 1.10 CHAPTER SUMMARY
- 1.11 CASE STUDY: XYZCORP INVESTIGATES PLATFORMS FOR MOBILITY AND EC/EB SERVICES
 - 1.11.1 *Mobile Application Server Project*
- 1.12 REVIEW QUESTIONS AND EXERCISES
- 1.13 ADDITIONAL INFORMATION

2 ECOMMERCE PLATFORMS FOR C2B TRADE -- THE COMMERCE SERVERS

- 2.1 INTRODUCTION
- 2.2 INTERNET-BASED PURCHASING OVERVIEW
 - 2.2.1 *An Example -- Getting Sam Started in eCommerce*
 - 2.2.2 *A Simple C2B Purchasing Example*
 - 2.2.3 *A Simple B2B Purchase Example*
- 2.3 C2B ECOMMERCE MIDDLEWARE
 - 2.3.1 *Extranets and Virtual Private Networks (VPNs) for ECommerce*
 - 2.3.2 *Shopping Carts*
 - 2.3.3 *Catalog Management systems*
 - 2.3.4 *XML for Ecommerce*
 - 2.3.5 *Sample XML Source and DTD for Purchase Order*
 - 2.3.6 *Ecommerce Transaction Processing*
 - 2.3.7 *Electronic Payment Systems -- An Example of Transaction Processing*
- 2.4 SECURITY FOR ECOMMERCE/EBUSINESS
 - 2.4.1 *Overview*
 - 2.4.2 *Overview of Core Security Technologies*
 - 2.4.3 *Information Protection (Privacy and Integrity)*
 - 2.4.4 *Authentication and PKI*
 - 2.4.5 *Authorization and Access Control*
 - 2.4.6 *Accountability and Assurance*
 - 2.4.7 *A Security Example*
 - 2.4.8 *Summary of Security*
- 2.5 ELECTRONIC COMMERCE PLATFORMS: PACKAGING EC MIDDLEWARE
 - 2.5.1 *IBM Net.Commerce Technologies and WebSphere*
 - 2.5.2 *Oracle E-Commerce Platform*
 - 2.5.3 *Microsoft Internet Commerce Strategy*
 - 2.5.4 *Netscape EC Servers and the Sun iPlanet Platform*
 - 2.5.5 *Open Market*
 - 2.5.6 *BroadVision*
 - 2.5.7 *Miva Merchant*
- 2.6 OUTSOURCING CONSIDERATIONS
 - 2.6.1 *Outsourcing the Web Server*
 - 2.6.2 *Outsourcing the Commerce Server*
 - 2.6.3 *Outsourcing the Payment Systems*
 - 2.6.4 *Outsourcing the Payment Authorization and Processing*
 - 2.6.5 *Outsourcing the entire Ecommerce Operation (e-Store)*
- 2.7 CONCLUDING COMMENTS
- 2.8 CASE STUDY: ONLINE PURCHASING FOR XYZCORP
- 2.9 REVIEW QUESTIONS AND EXERCISES
- 2.10 ADDITIONAL INFORMATION

3 B2B PLATFORMS AND STANDARDS – THE B2B SERVERS

- 3.1 INTRODUCTION

- 3.2 B2B DIRECT INTERACTIONS (SUPPLY CHAINS) -- ANOTHER LOOK
 - 3.2.1 *Overview*
 - 3.2.2 *Supply Chain Management (SCM) Middleware Services*
- 3.3 B2B THROUGH INTERMEDIARIES -- ANOTHER LOOK
 - 3.3.1 *Overview*
 - 3.3.2 *Middleware for eMarkets*
- 3.4 MIDDLEWARE TECHNOLOGIES TO SUPPORT B2B COMMERCE - A QUICK OVERVIEW
- 3.5 B2B MESSAGE EXCHANGES BETWEEN PARTNERS -- EDI AND XML
 - 3.5.1 *Electronic Data Interchange (EDI)*
 - 3.5.2 *XML for Ecommerce*
- 3.6 B2B MIDDLEWARE NEEDED TO SUPPORT EMARKETS
 - 3.6.1 *Mediators for eMarkets and the Role of XML*
 - 3.6.2 *Web Content Development ("Web Farming")*
 - 3.6.3 *Mediating Electronic Product Catalogs*
- 3.7 B2B EXCHANGES STANDARDS (EBXML, PIPS) -- EFFORTS TOWARDS INTEROPERABILITY
 - 3.7.1 *OASIS, ebXML and UBL*
 - 3.7.2 *ebXML -- A Closer Look*
 - 3.7.3 *RosettaNet*
 - 3.7.4 *CommerceOne and Marketsite.net*
 - 3.7.5 *BizTalk.org and XML.Org*
- 3.8 WORKFLOW MANAGEMENT
 - 3.8.1 *Workflow Concepts*
 - 3.8.2 *Workflow Management System—The Middleware to Support Workflow*
 - 3.8.3 *Business Process Modeling - Some Details*
 - 3.8.4 *The Evolution of Workflow Management Systems*
 - 3.8.5 *Workflow Management Products - State of the Market*
 - 3.8.6 *IBM's MQSeries WorkFlow - Example of a Workflow Product*
- 3.9 ENTERPRISE APPLICATION INTEGRATION (EAI) PLATFORMS
 - 3.9.1 *Overview*
 - 3.9.2 *EAI Platform Concepts*
 - 3.9.3 *Application Connectivity - The Publish//Subscribe Model*
 - 3.9.4 *Information Transformation (Application Adapters and Data Translators)*
 - 3.9.5 *Process and Workflow Management*
 - 3.9.6 *EAI Platform State of the Market*
- 3.10 EXAMPLES OF B2B PLATFORMS – THE B2B SERVERS
 - 3.10.1 *Oracle Exchange eMarket Platform*
 - 3.10.2 *Hewlett Packard's e-speak*
 - 3.10.3 *Supply Chain Products from i2*
 - 3.10.4 *B2B Application Integration Platforms (EAI for B2B)*
 - 3.10.5 *MCC's CMI: Rapid Prototyping of BTB Applications using Dynamic Workflow.*
- 3.11 CONCLUDING COMMENTS
- 3.12 CASE STUDY: XYZCORP B2B SERVICES AND PLATFORMS
- 3.13 REVIEW QUESTIONS AND EXERCISES
- 3.14 CHAPTER REFERENCES

4 PLATFORMS FOR MULTIMEDIA AND COLLABORATION

- 4.1 INTRODUCTION
- 4.2 PLATFORMS FOR DISTRIBUTED MULTIMEDIA APPLICATIONS
 - 4.2.1 *Overview*
 - 4.2.2 *Multimedia Over the Internet -- The Protocol Stack*
 - 4.2.3 *Lower Network Issues to Support Multimedia Applications*
 - 4.2.4 *Data Transport Protocols: RTP (Real-time Transport Protocol) and RTCP (Real-Time Control Protocol)*
 - 4.2.5 *Session Establishment: RTSP, SIP, and SAP*

- 4.2.6 *Presentation Middleware For Distributed Multimedia Applications*
- 4.2.7 *State of the Practice, Market and Art*
- 4.3 GROUPWARE AND COLLABORATION SERVERS
 - 4.3.1 *Overview*
 - 4.3.2 *Groupware: From Lotus Notes to Groove*
 - 4.3.3 *Collaborative Learning in Internet2*
 - 4.3.4 *State of the Practice, Market, and Art*
- 4.4 DISTRIBUTED OPERATING SYSTEMS
 - 4.4.1 *Principles of Distributed Operating Systems*
 - 4.4.2 *Distributed Operating System Versus a Network Operating System*
 - 4.4.3 *Design Issues in Distributed Operating Systems*
 - 4.4.4 *Examples of Distributed Operating Systems*
- 4.5 APPLICATION SERVERS -- EVOLUTION OF PACKAGING MIDDLEWARE SERVICES
- 4.6 THE NEXT GENERATION MIDDLEWARE
- 4.7 SUMMARY
- 4.8 CASE STUDY: XYZCORP INVESTIGATES EMERGING MIDDLEWARE SERVICES AND PLATFORMS
- 4.9 PROBLEMS AND EXERCISES
- 4.10 ADDITIONAL INFORMATION

5 APPLICATION SERVERS STATE OF THE PRACTICE, MARKET, AND ART

- 5.1 INTRODUCTION
- 5.2 APPLICATION SERVERS -- STATE OF THE PRACTICE CASE STUDIES
 - 5.2.1 *A General Approach for a Small Chain of Stores*
 - 5.2.2 *AIRTIS Wireless Traffic and Weather Solution*
 - 5.2.3 *Microsoft Application Server at Honeywell*
 - 5.2.4 *Telekom Malaysia*
 - 5.2.5 *Coca-Cola Integrates Business Processes with BizTalk Server 2000*
 - 5.2.6 *A B2B Food Exchange*
 - 5.2.7 *Fubon Uses WebSphere*
 - 5.2.8 *Party Warehouse Uses Integrated Applications*
 - 5.2.9 *Digex Uses MS Commerce Server for Hosted Application Services*
- 5.3 STATE OF THE MARKET -- COMMERCIAL APPLICATION SERVERS
 - 5.3.1 *Commercial Mobile Application Servers (MASs)*
 - 5.3.2 *Commercially Available e-Commerce Servers*
 - 5.3.3 *Commercially Available B2B Servers*
- 5.4 STATE OF THE ART -- APPLICATION SERVER EVOLUTION AND TRENDS
 - 5.4.1 *Overview*
 - 5.4.2 *Evolution of Application Servers*
 - 5.4.3 *Super Application Servers*
 - 5.4.4 *Examples of Super Application Servers*
 - 5.4.5 *Summary and Trends of Application Servers*
- 5.5 EXERCISES

