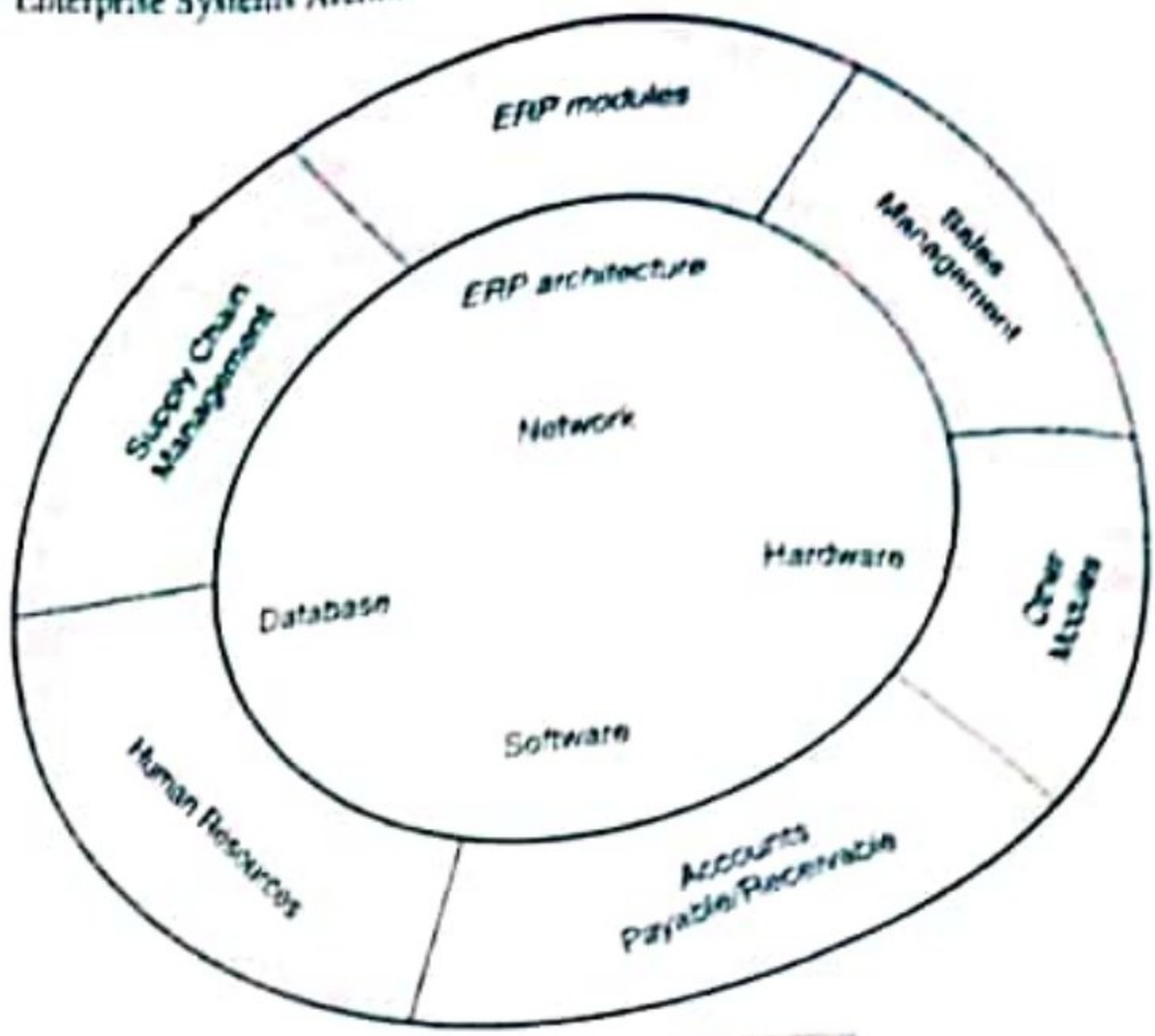

FIGURE 3-1 Enterprise Systems Architecture (ESA) Model

Understanding the enterprise system architecture is important for several reasons. First, it helps management and the implementation teams understand in detail the features and components of the enterprise system. Second, it provides a visual representation of the complex system interfaces among the ERP application and databases, operating systems, legacy applications, and networking. Finally, understanding the enterprise systems architecture, by clarifying the system infrastructure requirements, training requirements, change management requirements, and business process reengineering requirements, among others, can help management in developing a better IT plan.

The enterprise systems architecture (Figure 3-1) can be viewed from two different angles: (1) the functional angle that defines the *ERP modules* that support the various business functions of the organization and (2) the system angle that defines the *ERP architecture* through the physical components of hardware, software, and networking. In this chapter, you will learn more about the typical ERP modules, the system architecture and components, types of ERP architecture, and, finally, the role of architecture and its impact on the implementation stage of the project.

ERP MODULES

The key role of an ERP system is to provide support for such business functions as accounting, sales, inventory control, and production for the various stakeholders of the organization. Organizations often selectively implement the ERP modules that are both economically and technically feasible. ERP provides the same functionality to the users (e.g., the silo systems of the past), but the data are integrated or shareable across all the ERP modules. This means

SELF-SERVICES

- Enable flexible support for employees' business functions with views of information tailored to their needs
- Empower employees and managers through simplified access to relevant information for management, financials, operations, and analytics, while boosting motivation, productivity, and efficiency

PERFORMANCE MANAGEMENT

- Improve business insight and productivity by delivering real-time, personalized support ments and metrics
- Provide executives, managers, and business workers with access to such information business statistics and key performance measurements presented in the context of business tasks

FINANCIALS

- Ensure compliance and predictability of business performance
- Gain deeper financial insight across the enterprise and tighten control of finances
- Automate financial and managerial accounting and financial supply chain management
- Provide rigorous support for financial reporting and such corporate governance mandates as the Sarbanes-Oxley Act and Basel II

HR MANAGEMENT

- Attract the right people, develop and leverage their talents, align their efforts with corporate objectives, and retain top performers
- Increase efficiency and help ensure compliance with changing global and local regulations by using standardized and automated workforce processes
- Enable creation of project teams based on skills and availability, monitor progress of projects, track time, and analyze results
- Manage human capital investments by analyzing business outcomes, workforce trends, demographics, and workforce planning

PROCUREMENT AND LOGISTICS EXECUTION

- Sustain cost savings for all spending categories by automating such routine tasks as determining sources and converting requisitions into purchase orders and by allowing employees to use electronic catalogs to order products and services
- Reduce costs through process automation, integration of suppliers, and better collaboration
- Improve resource utilization with support for cross-docking processes and data collection technologies such as radio frequency identification (RFID) and bar codes
- Enhance productivity of all activities related to incoming and outgoing physical goods movement
- Reduce transportation costs through better consolidation and collaboration

PRODUCT DEVELOPMENT AND MANUFACTURING

- Shorten time to market through streamlined new-product development and introduction processes

Sales and Marketing Module

Revenues from sales are the lifeblood for commercial organizations. The sales module implements functions of order placement, order scheduling, shipping, and invoicing. The sales module is closely integrated with an organization's e-commerce Web site. Many ERP vendors offer an online storefront as part of the sales module. On the other hand, the marketing module supports lead generation, direct mailing campaigns, and more.

Finance Module

The financial module benefits both for-profit organizations and nonprofit organizations. The financial module is the core of many ERP software systems. It can gather financial data from various functional departments and generate valuable financial reports (e.g., budgets, balance sheet, general ledger, trail balance, and quarterly financial statements).

Human Resource Module

The human resources (HR) module is usually the first model implemented by many companies. The HR module streamlines the management of human resources and human capital. The HR modules routinely maintain a complete employee database, including contact information, salary details, attendance, performance evaluation, and promotion. An advanced HR module is integrated with knowledge management systems to optimally utilize the expertise of all employees.

Miscellaneous Modules

Some vendors have started offering such nontraditional modules as business intelligence, self-service, project management, and e-commerce. For example, the business intelligence module offers tools and data warehousing capabilities to display real-time information through reports and to monitor historical trends. Furthermore, these reports can be viewed through the enterprise portal for decision making with executives who can be located around the globe and can collaboratively make decisions based on the same live data. Self-service is similarly an important module for present-day consumers because it satisfies their need for "instant gratification" in their everyday activities. It allows them to have more control over their purchasing, tracking, and research. Self-service also has many benefits for employees to include access to a company's intranet, 401Ks, leave and earnings statements, and so on. Employers are also discovering that there is cost savings associated with letting customers and employees take ownership of their inquiries and processing. In order for a company to take advantage of the cost savings, or for consumers and employees to take advantage of the freedom associated with self-service, an organization must focus on keeping the self-service capability as user-friendly as possible. This can be done by providing accurate information and a relatively easy method of database interaction.

Benefits of Key ERP Modules

The following details some of the key benefits touted by such ERP vendors as SAP and Oracle for the various application modules:

TABLE 3-1 ERP Modules from Three Vendors

Function	SAP Modules	Oracle/PeopleSoft Enterprise Modules	Microsoft Dynamics Modules
Sales	Sales and distribution, sales opportunity	Marketing and sales, supply chain management	Retail POS, field service management
Procurement	Purchasing, supplier relationship management	Procurement and supplier relationship management	Supply chain management
Production	MRP, product lifecycle management	Manufacturing	Manufacturing
Accounting	Financial accounting	Financial management	Financial management
Distribution	Warehouse management	Supply chain management	Distribution management
Customer services	CRM	CRM	CRM
Corporate performance and governance	Governance, risk, and compliance management	Corporate performance management	Analytics
Human resources	Human capital management	Human capital management	HR management
Miscellaneous	Banking	Campus solutions	e-Commerce, portals

Source: Adapted from Web sites of SAP Global, Oracle Applications, and Microsoft Dynamics, www.saptars.com/saptars.htm, www.oracle.com/applications/erp.html, www.microsoft.com/en/us/default.aspx (accessed January 15, 2007).

[ERP Modules =)

- **Production Module**

The production module helps in planning and optimizing the manufacturing capacity, part components, and material resources using historical production data and sales forecasting. Production modules have evolved from manufacturing requirements planning (MRP) II into ERP systems with the help of consulting firms who have accumulated vast knowledge of implementing a production planning module.

- **Purchasing Module**

The purchase module streamlines the procurement process of required raw materials and other supplies. It automates the processes of identifying potential suppliers, negotiating price, awarding purchase orders to the supplier, and billing processes. The purchase module is tightly integrated with the inventory control and production planning modules. The purchasing module is often integrated with supply chain management software and business-to-business (B2B) Web sites.

- **Inventory Management Module**

The inventory module facilitates the processes of maintaining the appropriate level of stock in a warehouse. Inventory control identifies inventory requirements, sets targets, provides replenishment techniques and options, monitors item usages, reconciles the inventory balances, and reports inventory status. Integration of the inventory control module with sales, purchase, and finance modules allows ERP systems to generate vigilant executive-level reports.

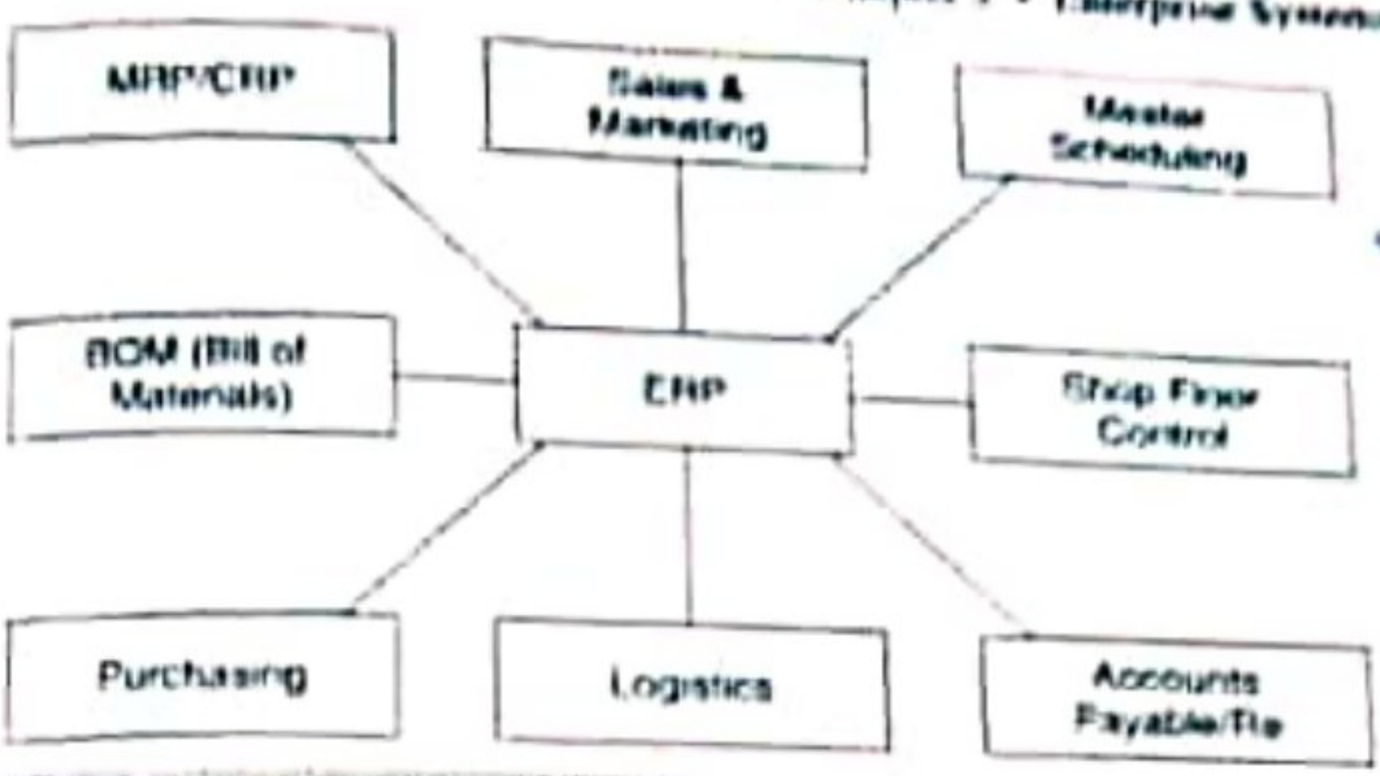

FIGURE 3-2 Typical ERP Modules

the data need to be entered into the system once, and, depending on the organization's business rules, they are made available to users either inside or outside the organization. In today's organization, teams are not limited to employees of the company; teams can include employees from various functional areas as well as employees of business partners and even customers. ERP systems, therefore, provide access to the data as defined by the organizations' business rules.

ERP vendors, including SAP, Oracle, and Microsoft, provide modules that support the major functional areas of the business (e.g., accounting, production, financial management, human resources (HR), sales order processing, and procurement). These modules provide the functionality to implement business policy and processes in accounting, production, finance, human resources, and so on. The ERP software embeds the best business practices into the software to allow organizations to implement their policies and procedures. ERP vendors often claim that these business practices will help improve organizations' productivity and performance. For example, a procurement module includes the best practices on purchasing (e.g., forms, routing, and methods of integrating with e-commerce application). Although the vendor claims are generally true, some business rules may conflict with the organization's policy. Customization or changes are therefore often necessary when implementing the ERP modules. Although this issue will be debated in more detail elsewhere in the book, suffice it to say that management needs to evaluate carefully when and how much modification is essential. ERP software provides different level of flexibility in modifying the system during implementation. Careful evaluation is therefore necessary when selecting the software to avoid problems later.

In general, ERP vendors provide a comprehensive range of enterprise software applications and business solutions to empower every aspect of business operations, identify new business opportunities, and enable the organization to respond to changing business realities. In addition, they include functionality to optimize business operations and resources to extend best practices to the entire value chain. Table 3-1 provides a high-level overview of the usual modules provided by major ERP vendors.

The functional and module list is not exhaustive and does not include all the enterprise software applications provided by these vendors. The following is a brief overview of some of these ERP modules.

- Deliver higher-quality products and ensure delivery of promised orders through optimal planning, scheduling, and sequencing on the factory floor
- Improve visibility and transparency in real time across all shop floor processes, including availability checking and costing

SALES AND SERVICE

- Increase the number of sales orders processed and reduce administrative costs through automation of sales order management and the use of such profitable Internet-based solutions as e-commerce
- Deliver greater customer satisfaction by providing easy access to accurate, timely information
- Streamline processes that facilitate cost-effective mobile access for field employees
- Improve the management of incentives and commissions to maximize productivity and boost sales
- Reduce travel costs by using online functions for planning, booking, and expense accounting while ensuring that company policies are applied to all processes
- Realize more effective real estate management, supported by tools that streamline and manage every stage of the real estate life cycle
- Adhere to environmental, health, and safety reporting requirements

ERP ARCHITECTURE

n today's business environment, ERP applications are most commonly deployed in a distributed nd often widely dispersed manner. While the servers may be centralized, the clients are usually read across multiple locations throughout the enterprise. ERP system architecture is organized layers or tiers to manage system complexity in order to provide scalability and flexibility via a ug-n-play systems capability. This is highly essential in an enterprise-level system. Three-layer chitecture is the most prevalent today and includes Web, application, and database servers. It is most reliable, flexible, and scalable architecture. You can scale the number of users from to 100 by adding servers. This is one example of simple hardware layering that has a signifi- nt impact on scalability. What if the layering is done at both the hardware and software vironments? The scalability would have been 20-fold instead of just 10-fold. It is important to derstand, therefore, that layering is merely a model of dividing the hardware and software in nformation system. It is not limited to three tiers, but often supports many tiers. Hence, the n "N-tier client–server architecture" is often used to describe enterprise system architectures he term *N*-tier, *N* implies any number (e.g., three-tier, four-tier, or, basically, any number o net tiers used in your architecture).

ered Architecture Example

xample of a layered ERP architecture is the Info.Net[1] architectures shown in Figure 3- architecture generalizes the functional layers to allow it to change with newer technologi architecture provides a Web-based user interface (i.e., user can access the applications nternet through a PC). The PC needs to be capable of running a Java-enabled Web brow