

APPLICATION LAYER MODEL

The Application Layer (AL) is the key component of the whole Enterprise Information Infrastructure (EII). Its architecture evolves from routines (1960's) to applications (1970's), to information systems (1980's), to enterprise-wide system packages such as ERP, SCM, and CRM (1990's). In general, one can recognize three major components of AL:

- Enterprise Computing (EC):
 - Business Information Systems (BIS),
 - Product/Service Information Systems (PIS),
 - Operation Information Systems (OIS),
 - Management Information Systems (MIS),
 - Inter-Organizational Systems (IOS),
 - E-Business applications,
- End-User Computing (EUC).
- Inter-organizational Computing (IOC) as an exit to B2B, B2C and EII to NII, GII, LII links through computer networks.

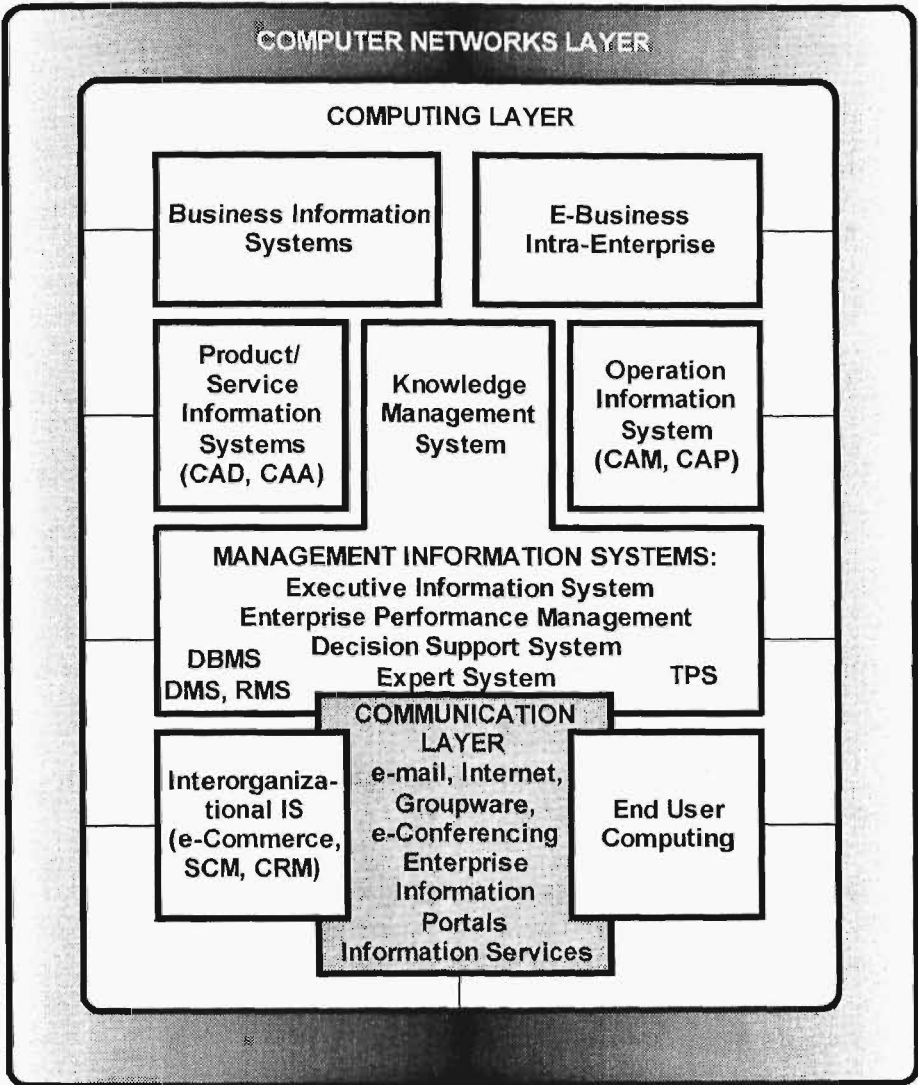
These systems are supported by info-communication systems from the Communication Layer:

- Info-Communication Systems:
 - E-mail,
 - Internet, Intranet, Extranet,
 - Groupware,
 - Work Flow System,
 - E-Conferencing,
 - Enterprise Information Portal,
 - Information Services.

The AL interacts with other EII layers such as the Communication Layer and the Computing Layer. This last layer makes AL more dynamic by the interaction with the Computer Networks Layer. All the systems and interacting layers are depicted in Figure 4-3.

From the formal point of view one can classify a set of Business Information Systems (BIS) as follows:

Figure 4-3: The Generic System Architecture of Application Layer (CAA–Computer-Aided Advertising, CAP–Computer-Aided Publishing, DBMS–Data Base Management System, DMS–Document Management System, RMS–Records Management System, WFS–Work Flow System) (The Targowski Model)



- Marketing Information System,
- Financial Information System,
- Accounting Financial System,
- Human Resources Information System,
- Legal Information System,
- Administration Information System,
- Other.

It is interesting to notice that the Marketing Information System evolves into CRM-Customer Relationship Management system, and Financial IS and Accounting IS evolves into one integrated IS as it takes place in PeopleSoft's implementation.

A set of Product/Services Information Systems (PIS) can be classified into the following categories:

- Computer Aided Engineering (CAE),
- Computer Aided Editing (CAED),
- Computer Aided Drafting (CAD),
- Computer Aided Advertising (CAA),
- Computer Aided Drafting and Design (CADD),
- Computer Aided Planning (CAPP),
- Computer Aided Software Engineering (CASE),
- Geographic Information System (GIS)
- Other.

These systems are implemented as stand-alone workstations with customized software for a given engineering job. Also, CADD systems are very often integrated with Computer Aided Manufacturing Systems (CAM) as CAD/CAM systems in a so-called Computer Integrated Manufacturing system (described later).

Operation Information Systems (OIS) can be recognized as a set of the following categories:

- Process Control System,
- Computer Aided Manufacturing (CAM),
- Computer Aided Publishing, and other,
- Data Collection System,
- Quality Control System,
- Automated Material Handling System,
- Automated Storage and Retrieval System,
- Production/Service Operations Planning System,
- MRP I (Material Planning Requirements) System,
- MRP II (Manufacturing Resources Planning) System,
- Inventory Control System,
- Shop-Floor Control System,
- Service Management,
- Plant/Organization Maintenance System,
- Project Management System,
- Other.

Management Information Systems (MIS) are described in this chapter later. Inter-organizational Systems (IOS) evolve into e-commerce and the so-called B2B (Business-To-Business), B2C (Business-To-Consumer), and C2C (Consumer-To-Consumer systems) described in Chapter 6. E-Business applications are of a different substance, and very often are limited to e-commerce applications. In a broader sense, they are singular business routines implemented in Web technology and they are described in Chapter 6.

A combination of BIS, PIS, OIS, MIS, IOS, and e-Business applications evolves into a set of integrated applications called ERP (Enterprise Resource Planning); associated with them are more independent combinations of BIS and OIS such as SCM (Supply Chain Management) and CRM (Customer Relations Management). Each of these combinations (varied from vendor to vendor) is modeled in the following sections.

Data Management Systems evolved from file management systems into Database Management Systems (DBMS) that in the 1980's became relational databases, composed of multiple, related tables (RDBMS). A typical DBMS is composed of three subsystems:

- Data Description Language (DDL) for defining and loading data,
- Data Manipulation Language (DML) for querying data, recently known as SQL (Sequential Query Language), which became the standard,
- Data Dictionary (DD), which describes properties of data elements.

Whatever the database technology, there are certain business-critical requirements that apply to applications, irrespective of the complexity of their information structures:

- An acceptable total cost of ownership, with simple administration,
- 24x7 availability of service,
- A consistent view of current data to all users, wherever they are and whatever their mode of access is,
- Reliable access for all current users,
- Strong security.

Among the most popular RDBMS are IBM DB2, Oracle, MS SQL, and Informix.

Transaction Processing Systems (TPS) are the simplest of all applications; however, they are also the most important since they feed data to all other applications, mostly through DBMS.

ERP SYSTEMS – *BACK-OFFICE AUTOMATION*

The ERP system emerged from the gradual integration of several enterprise-wide applications. At the first stage of integration in the 1970-80's the MRP I (Material Requirements Planning) system was formed from such applications as BOMP (Bill of Material Processor), Net Requirements Planning, and Gross Requirements Planning. At the next stage of integration in the 1980's the MRP II (Manufacturing Resources Planning) system was created as a result of integrating such applications as Capacity Requirements Planning (CRP), Production Planning, Subcontracting Planning, and others.

In the 1990's all of the above systems were integrated into the ERP system, which also incorporated other applications of the back-office, such as Financials, Human Resources, Project Management, Plant Maintenance, and others. Typically, an ERP system is a software package composed of several applications supporting such business functions as sales, productions, finance, human resources, and others, providing for the horizontal integration of data across an organization's business processes that can be customized with specific design-programming tools of the 4th generation (Computer Aided Software Engineering).

Core ERP Applications include:

- Financials—accounting, financial processes, budgeting, assets management,
- Human Resources—payroll, benefits, compensation, performance assessment and enterprise total employee information, assuming compliance with requirements of multiple jurisdictions and tax authorities in the Global Economy,

- Manufacturing (or Operations²) – production/operations planning and execution, including a Bill Of material processor (BOMP), shop floor management, and quality control,
- Project Management – planning of project schedules, costs, contracts, and resources according to a budget.

Extended ERP Applications include:

- Product Life-cycle Management (PLM) – supports product planning and design and product information sharing with suppliers to optimize development of products,
- E-Procurement – helps buyers to acquire goods via online catalogues, auctions, and requests for quotes (RFQ),
- E-Logistics – supervises the transportation and storage of goods within the SCM,
- Customer Relations Management (CRM),
- Supply Chain Management (SCM),
- Business Intelligence – collects information from external and internal sources to analyze them for managers in their decision-making,
- Other.

ERP is the concept of developing applications that are fully integrated and can be used to automate many of the business routines of running a company. The advantage of ERP is the ability to integrate the data across a company. ERP systems, for example, allow manufacturing companies to adjust production and inventory automatically to meet fluctuating sales.

The ERP system reflects a generic solution based on a series of best practices in a given industry. It is contrary to the proprietary systems developed according to the specific requirements of a given organization. This approach imposes its own strategy and logic of applications, which forces changes in the way of doing business by a given company. If this is not the case, very often the ERP system's implementation can be a failure. For example, FoxMeyer

Drugs, a \$5 billion pharmaceutical wholesaler, filed for bankruptcy protection due to an incorrect implementation of the ERP system. Also, FoxMeyer filed a lawsuit against SAP's U.S. subsidiary and its implementation partner, Accenture Consulting, for \$500 million each for allegedly providing misleading assurances about the software's potential. On the other hand, the ERP vendor insists that the user did not introduce changes in business practices that are required by the SAP R/3 software.

Among top ERP vendors are SAP, PeopleSoft, Baan, Oracle, J.D. Edwards, and others.

ERP - SAP R/3 Application Software Model

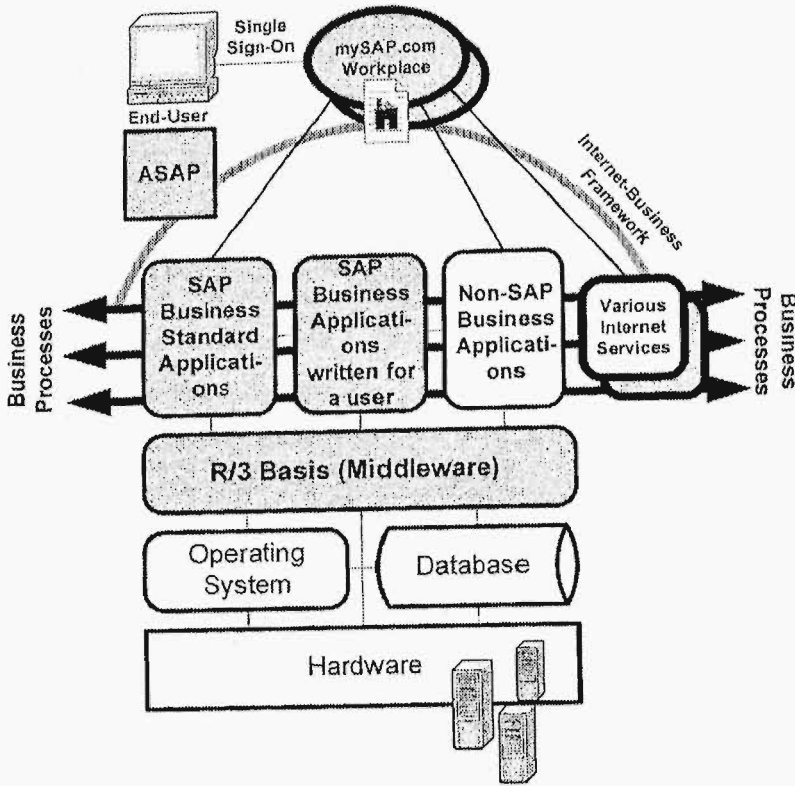
The most popular ERP software package is one developed by the German firm SAP (*Systeme Anwendungen und Programme in Der Datenverarbeitung*) as a SAP R/3 version (1992), which in fact is the enhanced version of IBM COPICS (Communication-Oriented Production Information Control System). This system was developed from a business point of view and became the important factor in reengineering legacy information systems in the 1990's. Figure 4-4 illustrates a concept of SAP R/3.

The R/3 software is a large-scale system which has about 500 million lines of code, 80,000 database tables, and 10,000 icons. It is a result of 30 years developmental effort by 1,000+ specialists, and it standardized 800 main business processes and converted them into an enterprise integrated information system.

The R/3 software system is composed of five main components:

1. SAP business standard applications, developed by the SAP corporation and configured for a given enterprise-user,
2. SAP business applications developed for a given, specific user, either by the SAP consultants or by third party integrators, or by the user itself,
3. mySAP.com Workplace is an enterprise portal which provides a single point of access via Web browser to all internal and external information via the Internet to accomplish your daily tasks, thereby delivering a complete e-business environment,
4. SAP Basis provides kernel functions that are used by application modules, and which plays a role of a middleware software. It has the role of

Figure 4-4: The General Architecture of R/3 Software System (The Targowski Model)



an abstraction layer and thus hides the application modules from all details of underlying operating system, database, and window system,

5. **ASAP-AcceleratedSAP**, which is a rapid implementation solution designed to streamline and standardize the implementation process to achieve mission critical business functionality as soon as possible (ASAP). ASAP's methodology is called the Roadmap, which supports the R/3 software system's implementation through five phases of:
 - **Phase 1: Project Preparation** (objectives, senior level management support, strategy for change, qualified team),
 - **Phase 2: Business Blueprint** (analysis of required business processes and associated information to include into standard and customized SAP applications),

- **Phase 3: Realization** (standard applications configuration, testing, and tuning)
- **Phase 4: Final Preparation** (final system testing and end-user training)
- **Phase 5: Go Live and Continuous Change**

mySAP.com Workplace allows you access to both SAP and third-party applications and Internet services. Its Cockpit provides MiniApps (intuitive, easy-to-use Web applications or Web documents), which include key reports from the SAP Business Information Warehouse, e-mail, and document alerts, as well as the following services:

- Small previews of full transactions (for example, system monitoring tools, lists of documents that are currently on hold, or lists of customers with overdue accounts),
- Commonly used functions that require a small amount of input where the user does not need to launch an entire application,
- Shared folders,
- Ad hoc queries,
- Wizards and navigation accelerators,
- Interfaces to third-party applications.

In the same way, the following mySAP.com components are integrated in the Workplace:

- Employee Self-Service (ESS) enables employees to be actively involved in human resources business processes. Employees can display, create and maintain certain types of data, anytime, anywhere, with an easy-to-use Web browser,
- Business-to-Business Procurement (BBP), e-commerce business process that enables employees to purchase goods and services directly from the provider,

- Advanced Planner & Optimizer (APO), a software solution for dynamic supply chain management; that is, active processing of the entire logistic chain (supply chain) from the vendor to the customer,
- Customer Relationship Management (CRM), umbrella term covering all aspects of business relationships with customers with the aim of fostering long-term customer loyalty,
- Strategic Enterprise Management (SEM), a group of tools and processes enabling managers to introduce company-wide value-oriented management procedures. It helps managers to translate their vision into real world actions. SEM links a strategy with operative activities and value drivers and thus turns the strategy into everyday business for every employee,
- Knowledge Warehouse (KW), integrated environment for creating, translating, presenting, distributing, and administering multimedia content through the application of a comprehensive range of tools and functions,
- Business Information Warehouse (BW), enables the evaluation of data from both SAP and non-SAP applications, often called data mining.

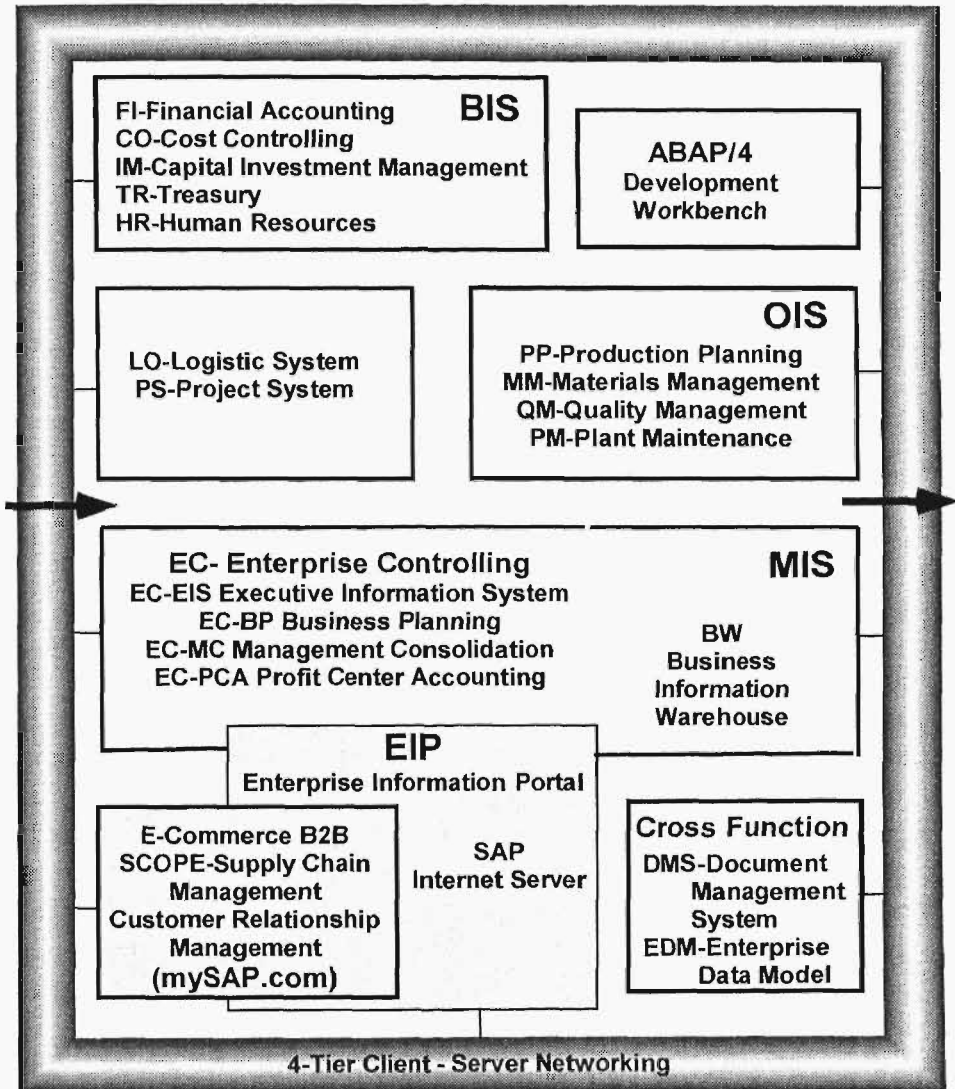
The R/3 Basis, as a software middleware, is composed of the following components:

- GUI – Graphic User Interfaces provided for each application,
- ABAP/4 Development Workbench to change standard applications or develop new applications that have the same properties as SAP's standard business applications,
- Database interface, where a database can be one of the commercial databases, such as Oracle, IBM DB 2, Microsoft SQL, Informix, and so forth,
- Workflow system, a support tool that can be used to optimize the execution of activities. Work steps carried out consecutively can be automated to coordinate a flow of information. Workflows bring the *right*

work in the *right* order at the *right* time to the *right* people working in different departments/divisions,

- Mail system among all users and administrators,

Figure 4-5: The Architecture of ERP SAP R/3 Systems Complex (The Targowski Model)



- Desktop's user presentation integration with appropriate business applications and system administration,
- Background processing to support concurrent processing of several tasks of the R/3 software system,
- Spool system to speed up a flow of data, procedures, and command among involved software components,
- System administration tools,
- Communication interfaces to external systems,
- Other.

The R/3 software system can work under main commercial operating systems such as UNIX (Sun Microsystems only), Windows NT+, IBM AS/400, and others.

The SAP R/3 system package is composed of about 25 modules (depending on how they are grouped) which are illustrated in Figure 4-5. When customized changes are introduced to one module of the package, other related data elements and modules are automatically updated.

MIS-MANAGEMENT INFORMATION SYSTEMS

In the past, Management Information Systems reflected all static systems developed for business information processing, characterized by their high-volume of transactions and lengthy reports, programmed in COBOL (user unfriendly language). These types of "systems" nowadays are called legacy systems. However, according to our AL generic model in Figure 4-3, MIS reflect systems that manage the whole enterprise, as is illustrated in Figure 4-6.

The system components of the MIS federation have the following purposes:

- GUI – Graphic User Interface – an on-screen menu which is easy to navigate through the enter key and arrow keys.