Enterprise Resource Planning Systems
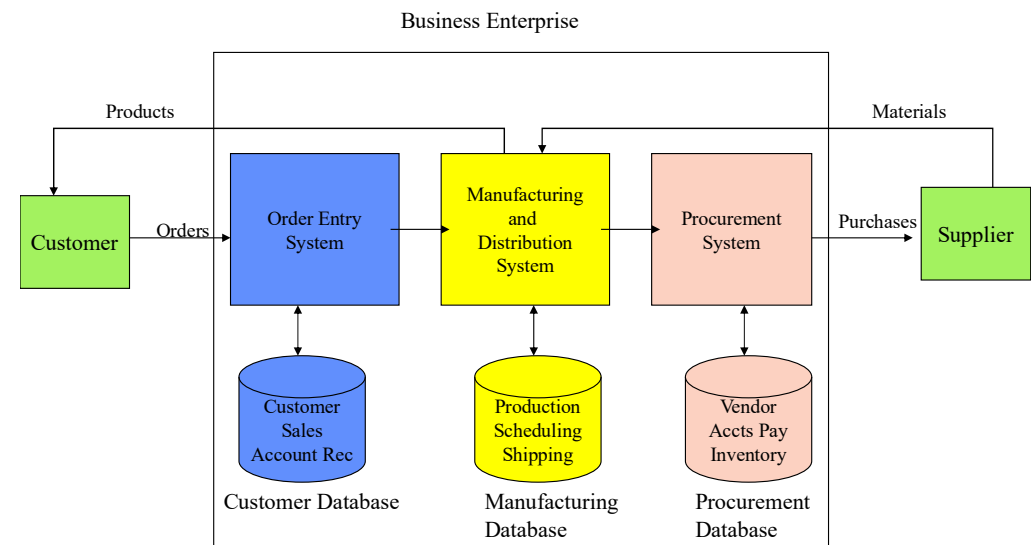

Problems with Non-ERP Systems

- In-house design limits connectivity outside the company
- Tendency toward separate IS's within firm
  - lack of integration limits communication within the company
- Strategic decision-making not supported
- Long-term maintenance costs high
- Limits ability to engage in process reengineering

Traditional IS Model:
Closed Database Architecture

- Similar in concept to flat-file approach
  - data remains the property of the application
  - fragmentation limits communications
- Existence of numerous distinct and independent databases
  - redundancy and anomaly problems
- Paper-based
  - requires multiple entry of data
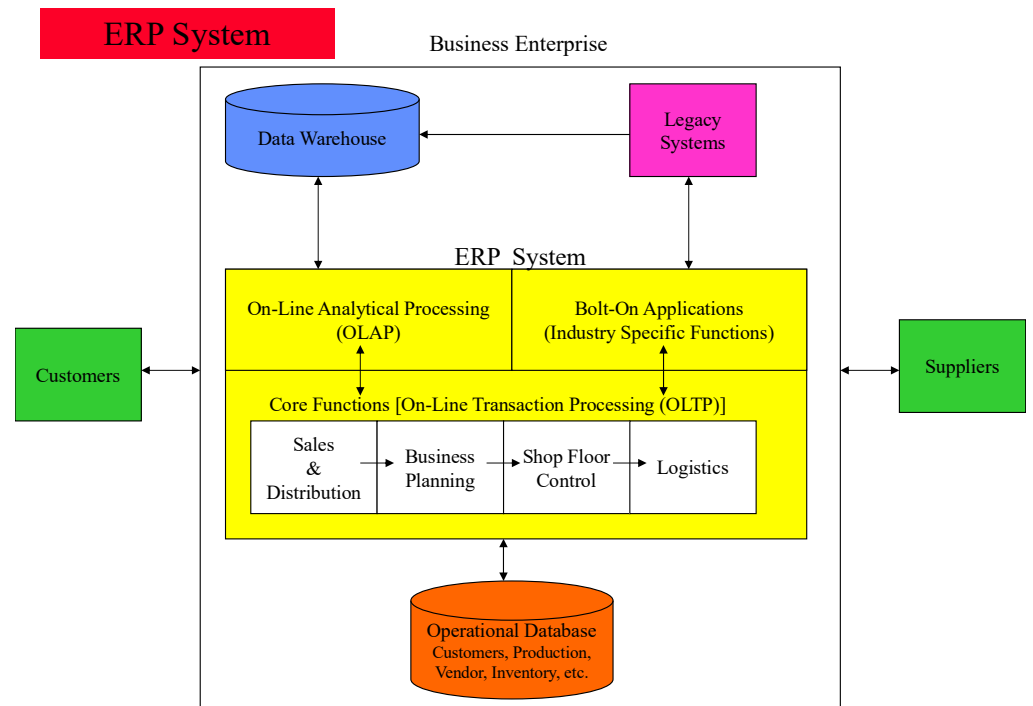 - status of information unknown at key points

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Business Enterprise

Products .... Materials

Customer — Orders → Order Entry System → Manufacturing and Distribution System → Procurement System — Purchases → Supplier

Customer Sales Account Rec — Customer Database

Production Scheduling Shipping — Manufacturing Database

Vendor Accts Pay Inventory — Procurement Database

Traditional Information System with Closed Database Architecture

What is ERP?

❚ Those activities supported by multi-module application software that help a company manage the important parts of its business in an integrated fashion.

❚ Key features include:

  ❙ Smooth and seamless flow of information across organizational boundaries

  ❙ Standardized environment with shared database independent of applications and integrated applications

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ERP System

Business Enterprise

Data Warehouse — Legacy Systems

ERP System

On-Line Analytical Processing (OLAP) | Bolt-On Applications (Industry Specific Functions)

Customers

Suppliers

Core Functions [On-Line Transaction Processing (OLTP)]

Sales & Distribution → Business Planning → Shop Floor Control → Logistics

Operational Database
Customers, Production, Vendor, Inventory, etc.

Two Main ERP Applications

Core applications

❚ a.k.a. Online Transaction Processing (OLTP)

❚ transaction processing systems

❚ support the day-to-day operational activities of the business

❚ support mission-critical tasks through simple queries of operational databases

❚ include Sales and Distribution, Business Planning, Production Planning, Shop Floor Control, and Logistics modules

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Two Main ERP Applications

Business analysis applications

❚ a.k.a. Online Analytical Processing (OLAP)

❚ decision support tool for management-critical tasks through analytical investigation of complex data associations

❚ supplies management with "real-time" information and permits timely decisions to improve performance and achieve competitive advantage

❚ includes decision support, modeling, information retrieval, ad-hoc reporting/analysis, and what-if analysis

OLAP

❚ Supports management-critical tasks through analytical investigation of complex data associations captured in data warehouses:

  ❚ **Consolidation** is the aggregation or roll-up of data.

  ❚ **Drill-down** allows the user to see data in selective increasing levels of detail.

  ❚ **Slicing and Dicing** enables the user to examine data from different viewpoints often performed along a time axis to depict trends and patterns.
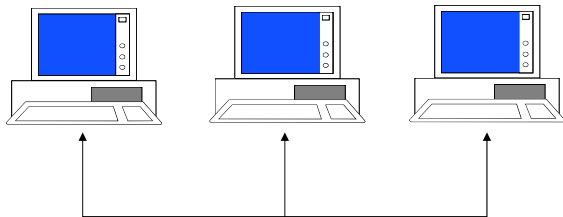
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ERP System Configurations:
Client-Server Network Topology

Two-tier

  ❚ common server handles both application and database duties
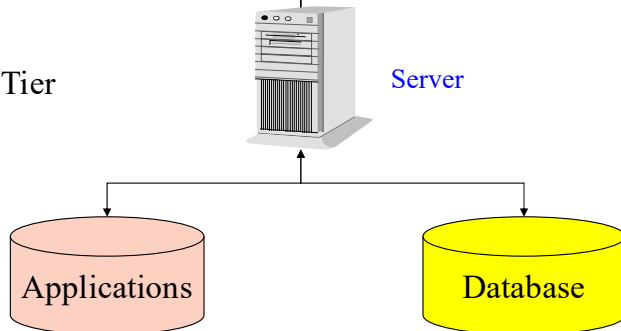
  ❚ used especially in LANs

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First Tier

User Presentation Layer

Second Tier

Server

Application and Database Layer

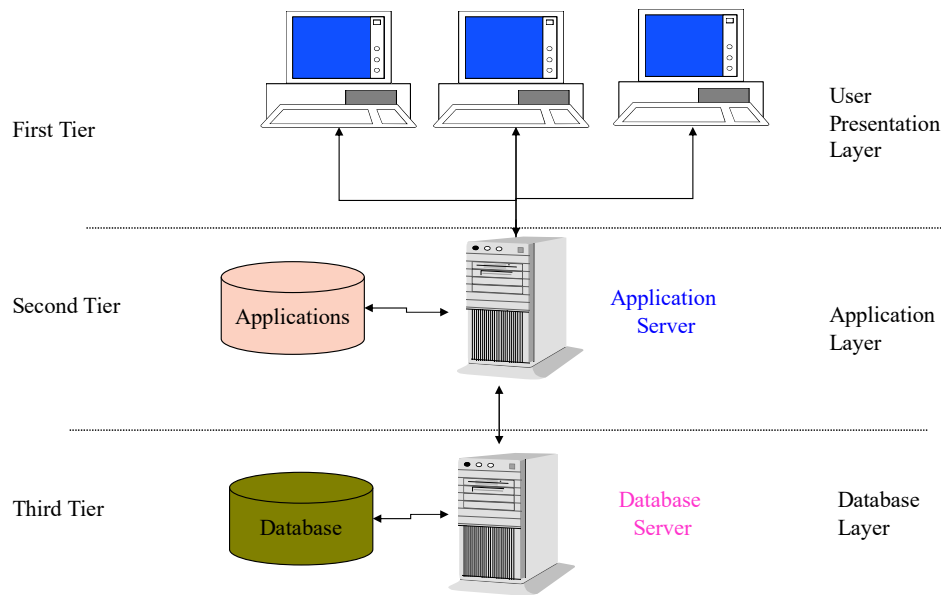Applications

Database

Two-Tier Client Server

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ERP System Configurations:
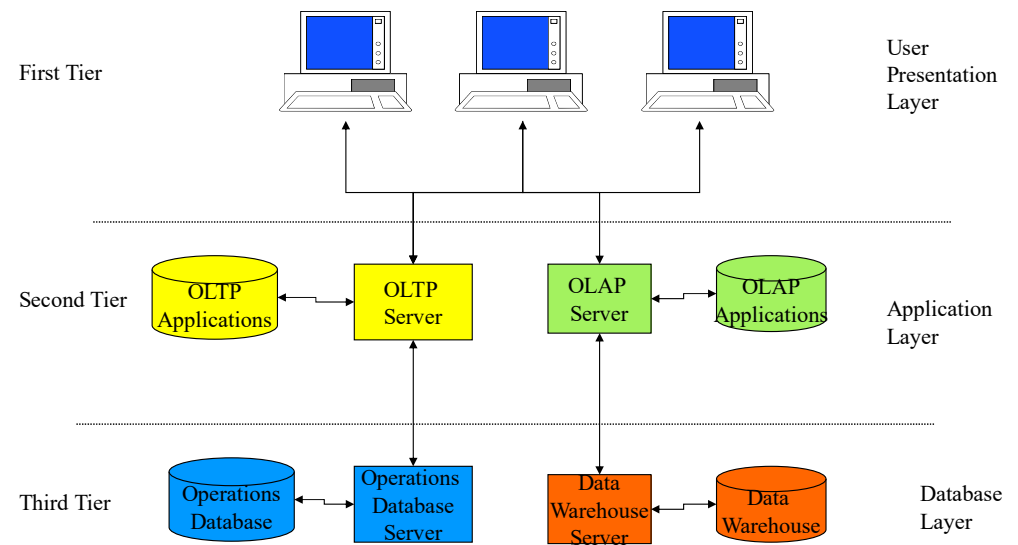## Client-Server Network Topology

Three-tier

  ❚ client links to the application server which then initiates a second connection to the database server

  ❚ used especially in WANs

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First Tier — User Presentation Layer

Second Tier — Applications — Application Server — Application Layer

Third Tier — Database — Database Server — Database Layer

Three-Tier Client Server

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First Tier — User Presentation Layer

Second Tier — OLTP Applications — OLTP Server — OLAP Server — OLAP Applications — Application Layer

Third Tier — Operations Database — Operations Database Server — Data Warehouse Server — Data Warehouse — Database Layer

ERP with OLTP and OLAP Client Server using Data Warehouse

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ERP System Configurations:
Databases and Bolt-Ons

❚ Database Configuration
- ❚ selection of database tables in the thousands
- ❚ setting the switches in the system

❚ Bolt-on Software
- ❚ third-party vendors provide specialized functionality software
- ❚ Supply-Chain Management (SCM) links vendors, carriers, third-party logistics companies, and information systems providers

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What is a Data Warehouse?

❚ A relational or multi-dimensional database that may consume hundreds of gigabytes or even terabytes of disk storage
- ❚ The data is normally extracted periodically from operational database or from a public information service.

❚ A database constructed for quick searching, retrieval, ad-hoc queries, and ease of use

❚ An ERP system could exist without having a data warehouse. The trend, however, is that organizations that are serious about competitive advantage deploy both. The recommended data architecture for an ERP implementation includes separate operational and data warehouse databases

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Data Warehouse Process

- The five essential stages of the data warehousing process are:
  - Modeling data for the data warehouse
  - Extracting data from operational databases
  - Cleansing extracted data
  - Transforming data into the warehouse model
  - Loading the data into the data warehouse database

Data Warehouse Process: Stage 1

- Modeling data for the data warehouse
  - Because of the vast size of a data warehouse, the warehouse database consists of de-normalized data.
    - Relational theory does not apply to a data warehousing system.
    - Wherever possible normalized tables pertaining to selected events may be consolidated into de-normalized tables.

Data Warehouse Process: Stage 2

- Extracting data from operational databases
  - The process of collecting data from operational databases, flat-files, archives, and external data sources.
  - Snapshots vs. Stabilized Data:
    - a key feature of a data warehouse is that the data contained in it are in a non-volatile (stable) state.

Data Warehouse Process: Stage 3

- Cleansing extracted data
  - Involves filtering out or repairing invalid data prior to being stored in the warehouse
    - Operational data are "dirty" for many reasons: clerical, data entry, computer program errors, misspelled names, and blank fields.
  - Also involves transforming data into standard business terms with standard data values

Data Warehouse Process: Stage 4

❚ Transforming data into the warehouse model

   ❚ To improve efficiency, data is transformed into summary views before they are loaded.

   ❚ Unlike operational views, which are virtual in nature with underlying base tables, data warehouse views are physical tables.

      ❙ OLAP, however, permits the user to construct virtual views from detail data when one does not already exist.
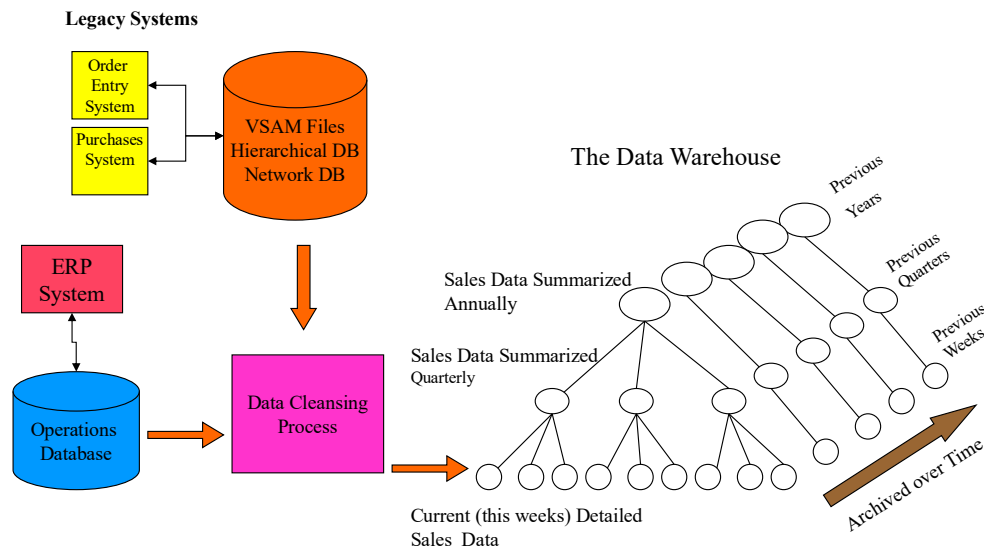
Data Warehouse Process: Stage 5

❚ Loading the data into the data warehouse database

   ❚ Data warehouses must be created and maintained separately from the operational databases.

      ❙ Internal Efficiency
      ❙ Integration of Legacy Systems
      ❙ Consolidation of Global Data

Data Warehouse System

Legacy Systems

Order Entry System

Purchases System

VSAM Files Hierarchical DB Network DB

ERP System

Operations Database

Data Cleansing Process

The Data Warehouse

Sales Data Summarized Annually

Sales Data Summarized Quarterly

Current (this weeks) Detailed Sales Data

Previous Years

Previous Quarters

Previous Weeks

Archived over Time

Risks Associated with ERP Implementation

❚ Pace of Implementation

   ❚ Big Bang--switch operations from legacy systems to ERP in a single event

   ❚ Phased-In--independent ERP units installed over time, assimilated and integrated

❚ Opposition to Changes to the Businesses Culture

   ❚ User reluctance and inertia

   ❚ Need of (upper) management support

Risks Associated with ERP Implementation

❚ Choosing the Wrong ERP
   ❚ Goodness of Fit: no ERP system is best for all industries
   ❚ Scalability: system's ability to grow
❚ Choosing the Wrong Consultant
   ❚ Common to use a third-party (the Big Five)
   ❚ Be thorough in interviewing potential consultants
   ❚ Establish explicit expectations

Risks Associated with ERP Implementation

❚ High Cost and Cost Overruns
   ❚ Common areas with high costs:
      ❙ Training
      ❙ Testing and Integration
      ❙ Database Conversion
❚ Disruptions to Operations
   ❚ ERP is reengineering--expect major changes in how business is done

Implications for Internal Control and Auditing

❚ Transaction Authorization
   ❚ Controls are needed to validate transactions before they are accepted by other modules.
   ❚ ERPs are more dependent on programmed controls than on human intervention.
❚ Segregation of Duties
   ❚ Manual processes that normally require segregation of duties are often eliminated.
   ❚ User role: predefined user roles limit a user's access to certain functions and data.

Implications for Internal Control and Auditing

❚ Supervision
   ❚ Supervisors need to acquire a technical and operational understanding of the new system.
   ❚ Employee-empowered philosophy should not eliminate supervision.
❚ Accounting Records
   ❚ Corrupted data may be passed from external sources and from legacy systems.
   ❚ Loss of paper audit trail

Implications for Internal Control and Auditing

- Access Controls
  - Critical concern with confidentiality of information
  - Who should have access to what?
- Access to Data Warehouse
  - Data warehouses often involve sharing information with suppliers and customers.

Implications for Internal Control and Auditing

- Contingency Planning
  - How to keep business going in case of disaster
  - Key role of servers requires backup plans: redundant servers or shared servers
- Independent Verification
  - Traditional verifications are meaningless
  - Need to shift from transaction level to overall performance level

Implications for Internal Control and Auditing

- ERP projects may be concurrent with BPR, CRM, Data Warehousing, SCM
- All of these increase risk of successful implementation
- ERP systems impact organizational structure and internal controls
- New control policies must precede migration to an ERP system

Implications for Internal Control and Auditing

Gartner Group noted following concerns regarding implementing ERP:

- Failure to meet user requirements
- Failure to integrate
- Incompatiblity with technical infrastructure
- Vendor support problems
- Expensive and complex installations

Audits of ERPs

Audit could provide assurance covering the areas of ...

- process integrity
- application security
- infrastructure integrity
- implementation integrity

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ERP Products

- SAP: largest ERP vendor
  - modules can be integrated or used alone
  - new features include SCM, B2B, e-commerce, XML
- J.D. Edwards
  - flexibility: users can change features; less of a pre-set structure than SAP's
  - modularity: accept modules (bolt-ons) from other vendors

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ERP Products

- Oracle
  - tailored to e-business focus
  - Internet based vs. client-server based applications
- PeopleSoft
  - open, modular architecture allows rapid integration with existing systems
- Baan
  - use of "best-of-class" applications

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- this concludes the ERP slide presentation

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