Chapter 10

ERP and Related Technologies

LEARNING OBJECTIVES

After reading this chapter, you will be able to understand:

- Electronic Data Interchange (EDI)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Data warehouse
- Data mining

10.1 INTRODUCTION

ERP integrates business of an organization through a centralized database. The organizational data and transaction data are stored in the database. This data is a rich source of information. There are many software tools that would process the data and discover useful patterns. These techniques are referred to as *data mining*. The data from an ERP system may not be directly usable by data mining tools. The data may have to be pre-processed and made ready for data mining. A data warehouse is created from the ERP data that makes the data ready for data mining. An organization needs to interact with their suppliers for obtaining the raw material or semi-finished goods. They also need to interact with their retailers and dealers. These interactions may happen using EDI technology. Supply chain management (SCM) refers to managing suppliers and retailers. Customers are the reason why a business exists. The focus has changed from providing customer a product to providing a service built around the product. Customer relationship management (CRM) is the technology that helps an organization to manage its customers. CRM and SCM both integrate with ERP system and are collectively referred to as ERP-II. In this chapter, the technologies which are related to ERP technology are discussed.

10.2 ELECTRONIC DATA INTERCHANGE

Electronic data interchange (EDI) is structured data interchange between two applications running on two different computers that may be heterogeneous and belong to two different organizations. The sender may not know the application used by the receiver and the exact nature of the application. The sender will not have any control on the application running on the receiver's site. The structure of the data that is interchanged through EDI is predefined and agreed upon by the two communicating applications. EDI is used for communicating documents such as invoices, purchase orders, shipping requests and acknowledgements. The advantages of EDI are as follows:

- Data is entered only once and then transmitted in a directly usable form to the

recipient whose information system may be very different from the sender's system.

- EDI reduces cycle time as data is transmitted in real time.
- EDI reduces paper work as documents arrive in electronic and usable form.
- The number of errors and chances of errors also gets reduced as data is entered only once.
- An indirect advantage of EDI is that both parties (sender/recipient) adapt standards for their documents.
- All above advantages together provide competitive advantage to both organizations involved.

10.2.1 EDI Standards

There are two popular EDI standards:

- ANSI X.12 or ASC X12
- EDIFACT International EDI OLE standard

Digital interchange of data that does not use either of these protocols is generally not treated as EDI. There are many other protocols such as XML, HTML and FTP for data interchange that are not treated as EDI. X12 and EDIFACT protocols occupy the application layer in TCP/IP protocol suite just like FTP, telnet, ping and SMTP. EDI protocol ensures peer-to-peer communication, reformatting the data if required (ASCII to EBCDIC for example), encrypt (decrypt) the data for security and perform error checking. E-mail is not treated as EDI as the data interchanged via e-mail is unstructured. Figure 10.1 is a simple depiction of EDI. There is a sender (who would be a receiver for other transactions) and a receiver (who would be a sender for other transactions). Both would install EDI system at their end that support agreed upon EDI protocol. EDI system interfaces with applications and network layer of TCP/IP. The application handovers the data to the EDI system. EDI system change the data in the format required by the corresponding EDI at receiver's end, perform the required encryption and other transformation to the data for communicating with transport layer (assuming that the communication is being done over TCP/IP which is the case most of the time). The data then travels to the receiver where transport layer handovers the data to the EDI system. EDI perform decryption and other required transformation to the data to make it suitable for the application. The data is finally handed over to the application. There is virtual communication between both applications shown with a broken line arrow in Figure 10.1. Virtual communication also takes place between both EDI systems. Such virtual communication is also termed as peer-to-peer communication.

ANSI X 12 Accredited Standards Committee (ASC) X12 was created by the American National Standards Institute (ANSI) in 1979 to develop what is now known as EDI standards. The protocol created by ASC is termed as ASC X 12 or simply X 12 or alternately ANSI X12. ASC X 12 has a set of over 300 transactions (documents) defined to transmit 300 different documents. The ASC members meet regularly to update X 12 transaction suite.

Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) is the international EDI standard developed under United Nation Economic Commission for

Europe in 1986–87. The maintenance work and further developments of this standard is done through the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) under the UN Economic Commission for Europe in the Finance Domain working group UN CEFACT TBG5. EDIFACT has been adopted by the International Organization for Standardisation (ISO) as the ISO standard ISO 9735. EDIFACT has a collection of 200 transactions/messages.

10.2.2 EDI Architecture

There are different ways with which EDI can be implemented. One is to install EDI in the organization, and the party with whom the organization communicates will also installs the system at their organization. The situation is shown in Figure 10.1. Another option is to avail EDI as a service from a vendor with whom one would communicate using e-mail (Figure 10.2). The party that one would communicate with, has EDI installed at their organization. The EDI system running at the provider's site would receive the documents via e-mail, extract the data from the document, put the data in the format that the receiving party expects, and then deliver the data to the receiving party. The reverse will be done to facilitate communication in the other direction. Third option is that both communicating parties avail EDI as a service from the vendors. The EDI service would then extract and convert the data to the desired format so that the communicating applications can use them without any human intervention. In the current scenario, EDI is becoming less popular and communication through Web sites over Internet is gaining popularity.

10.3 SUPPLY CHAIN MANAGEMENT

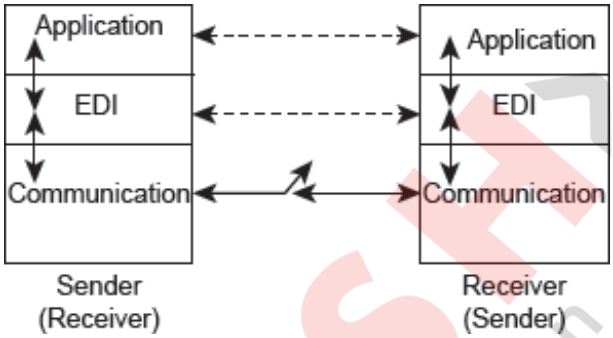
Supply chain management (SCM) is concerned with an efficient integration of suppliers, factories, warehouses, distributors and retailers so that the merchandise is produced and distributed in the following way:

- In the right quantity.
- To the right location.
- At the right time.

The objective is to satisfy customers' requirements at minimum cost. SCM systems focus on reducing lead time, redundant effort and inventory for minimizing the cost. All these efforts are required because production rate, demand and location of the demand for a product changes dynamically. All of the advanced strategies for SCM focus on global optimization and on managing uncertainty. Figure 10.3 shows the agencies involved in a supply chain. Suppliers of raw material and semi-finished products, manufacturer, wholesalers and retailers are all part of the supply chain. The raw material and semi-finished products flow to the manufacturer and the finished products flow downstream to the customers. The information about the demand, flows in the opposite direction to the flow of goods. It is simple to see that money flows in the direction opposite to the flow of goods. A manufacturer may obtain goods from various suppliers and may store the goods in multiple warehouses, a wholesaler may be served by more than one warehouse, and a retailer may also be served by multiple wholesalers. At each stage, there may be some amount of delay involved. The demand that is communicated by the retailer to the

manufacturer or anticipated by the manufacturer based on the historical data may be different from the actual demand. In order to meet the customer demand while keeping the cost under control, a SCM system must handle the following key issues.

FIGURE 10.1 Generic EDI Architecture



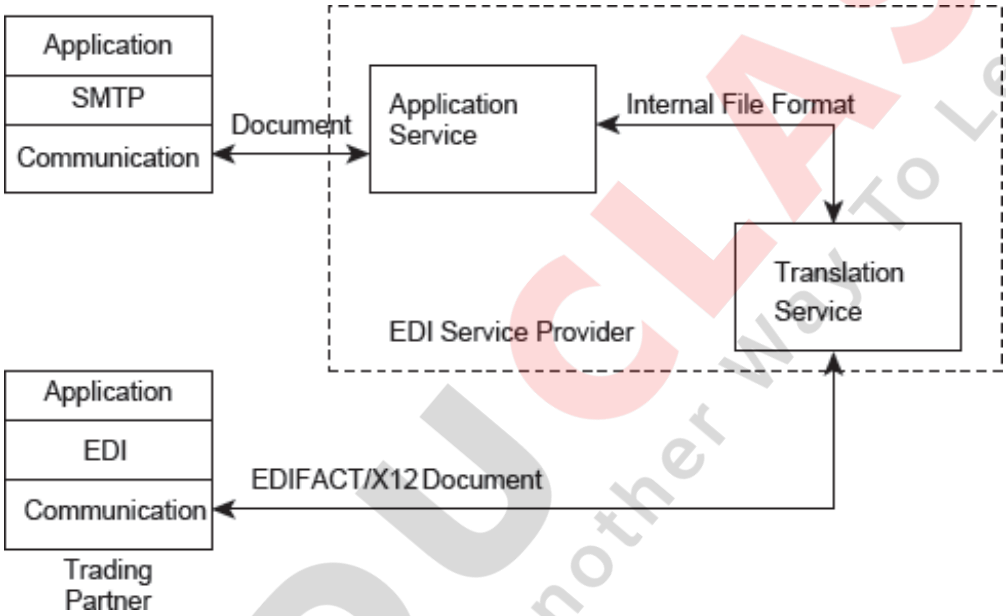


FIGURE 10.2 Architecture, When EDI is Provided as a Service by a Vendor

1. **Inventory management:** Inventory includes finished goods, semi-finished goods and raw material. Inventory also includes work-in-progress and goods in the pipeline. The goods in the pipeline include goods on their way to the manufacturer, warehouse and retailer. It is a challenging task to know the exact levels of inventory because multiple departments are involved. The procurement is done by the purchase department whereas goods are sold by the sales department. The work-in-progress happens in the manufacturing unit. An integrated system such as ERP makes it possible to know the exact levels of inventory. The objective of SCM is to maintain appropriate levels of inventory. Consider raw material, if a manufacturer does not have sufficient raw material available, production may have to be slowed down or stopped resulting in unutilized manufacturing capacity. Production, less than planned, will stop the supply to customers who may either start complaining or may switch to another product. If the inventory of raw material is more than required, the carrying cost of raw material adds to the cost of the product resulting in reduced project margins. The objective is to achieve appropriate levels of inventory.

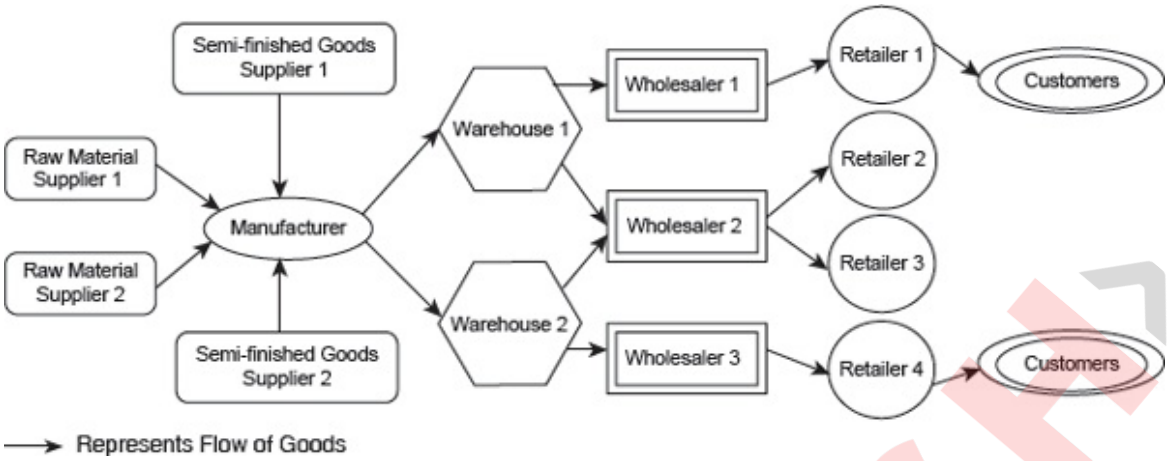


FIGURE 10.3 Agencies Involved in a Supply Chain [Flow of Money is in the Reverse Direction (not Shown in the Figure]

2. **Facility location:** Facilities include the manufacturing facility, distribution centres, retailers and warehouses. Locations of facilities have a bearing on the cost of transportation and manufacturing. Transportation cost is kept under control by economies of scale, i.e., the transportation cost is less when more is transported. If an organization has too many warehouses, then the cost of transportation to the warehouse and from warehouse to the retailer or the customer may become too high. The cost of the warehouse and their maintenance will also be prohibitive. The same argument holds true for manufacturing facility and distribution centres. The objective is to locate facilities at optimal locations. As the demand and supply both are uncertain, it is not possible to even define the optimal locations for various facilities. But if an organization has an ERP system, the past data can be utilized to estimate demand and used for better decision making.
3. **Forecasting:** Can we predict the demand? If we know the demand, we can work towards matching the supply with demand, by adjusting manufacturing schedules and quantity.

The demand is generated by the customers, i.e., communicated to the manufacturers by retailers through wholesalers. Customers do not come to the retailers to first announce their demands and then come later to pick up the product. The retailer has to anticipate and communicate the demand early enough to get the supply to meet the actual demand. One way is to use the past data to predict the future demand. Other method is to take average of the past data. The parameters involved are the time duration over which the average is taken and the weight assigned to the past data. The recent data may be assigned more weight than the older data. There are forecasting tools based on simulation, statistical analysis and artificial intelligence. These tools forecast and adapt the parameters to reduce the error in the actual demand and the forecast. The difference between the forecast and the actual demand would never be zero. Bursty demand during festival seasons and low demand during monsoon must be accounted for. There are other factors that will make a perfect match impossible—inexact data about inventory, pending orders, uncertainty in lead time, transportation time and availability of raw material.

There are many tools that implement various methods to forecast the demand. ERP systems provide these tools. One can also buy standalone forecasting software tools. The strategy when demand is estimated is referred to as push strategy. The responsiveness in

push strategy is much less, i.e., the manufacturer will take a long time to respond to the changes in the demand. If the demand decreases, an inventory may build up; and there may be unfilled orders (back orders) if the demand increases. *Push* strategy works if the product demand is stationary and the fluctuation in the demand does not cause inventory built-up or too many back orders.

A *pull* strategy is based on the demand information originating at the customer's end and is communicated to the manufacturer by wholesaler. The wholesalers get the information from their retailers and consolidate it before communicating to the manufacturer. Production is scheduled according to the customer orders. The manufacturer has to coordinate with their suppliers to quickly get the required supplies. This strategy works only if the entire supply chain is integrated and information flows from the customer to the manufacturer in real time. In practice, a combination of push and pull strategy is used. A manufacturer would keep the components ready based on the historical data and would produce the end-product after getting the orders.

10.3.1 Role of IT in SCM

Figure 10.3 shows all the agencies involved in the supply chain of a manufacturing organization. The figure also shows the material flow among various agencies. The information flows in the reverse direction of the material flow. The role of IT in managing flow of goods and information is discussed in this section.

EDI is discussed in Section 10.2 that is used for information interchange between two parties when both use different systems. EDI would help supplier receive orders from the manufacturer in real time. The distributors and retailers can also use EDI to communicate with manufacturers and with each other. Another option would be to use web-based services to let the supplier see the purchase orders and update the status of the order. A similar interface can be provided for the customers where they can upload their orders, and manufacturer and other concerned parties get to see the orders.

Global Positioning System (GPS) can be used to track the location of goods while in transit. The GPS system can be integrated with the ERP system of the manufacturing organization and other agencies. The sales department will use this information to answer queries regarding the status of their orders. The procurement department of the manufacturer would know the location of the raw material.

RFID is another technology that can help the SCM. When the goods enter the manufacturer's premises that have RFID tags associated with them, the data gets entered into the ERP system automatically without anyone having to enter the data manually. Same way, when goods arrive at the warehouse or retailers premises, the data about the material would become part of their information system automatically.

ERP system would help the manufacturer in keeping track of the inventory and customer orders. An ERP system would also help the manufacturer in forecasting the demand based on the historical data. The performance of the forecasting algorithm can also be checked against the actual demand, and the parameters of the algorithm may be adjusted for better performance.

Warehouse Management Systems (WMS) is another IT system that can be used to manage a warehouse better. A WMS provide functions for controlling storage and material movement in the warehouse. WMS is also part of large ERP systems. One can define logical storage locations for storing the material and goods. The material can be reserved for picking up later for delivery through WMS. Once the material is removed from the warehouse, the corresponding data in the ERP system is modified.

There are specific software solutions for transportation planning, inventory positioning and load planning. These are decisions made at tactical levels. Such solutions would integrate with ERP system and get the data which are used for analysis and decision making.

It remains a challenge for most of the organizations to seamlessly integrate the suppliers, wholesalers and retailers and to maintain accurate data across entire supply chain in real time. Every software adds to the cost, and overheads to the system. But the SCM systems have considerably reduced the lead time for pull-based supply chains from 90 days to 3 days in last 50 years.

10.4 CUSTOMER RELATIONSHIP MANAGEMENT

An organization deals with a potential customer (marketing), a customer (sales) and an existing customer (after sales). The objective of marketing department is to turn a potential customer into a customer. The sales department would like to serve the customer to their satisfaction. A company can serve its customers better by knowing them and their requirements. A customer expects a product that meet their requirements in terms of functionality and quality. A customer would like to find the product on the shelf when they go for shopping of the product or would like the product to be delivered to them in a timely manner. If a product requires after sales service, customer expects the company to honour its service level agreement (SLA) and provide service within agreed time. CRM refers to IT solutions that cover all these activities of the organization. CRM covers end-to-end customer interface with the company. CRM plays different roles for a customer, marketing team, sales team and after sales service team. The management would also like to get reports through its CRM system for strategic planning. The roles of CRM from different perspectives are described below.

Customer's perspective: CRM provides an interface to the company. A company aims to achieve the following through its CRM system.

- To provide information about the product and services through a Web site.
- To provide web interface to the customer for placing and tracking an order.
- To provide a web interface for lodging a complain.
- For customer support.

Marketing team's perspective: Marketing force of a company would like to use CRM to answer the following questions:

- Who should we target as potential customers?
- How should we reach out to potential customers?
- How successful our efforts have been?
- Are our efforts cost effective?

Sales force perspective

- Orders that have been received.
- Status of the orders.

After sales service team's perspective

- What are the complaints?
- What is the status of complaints?
- What is the schedule of after-sales services?

Management's perspective

- Who are our loyal customers?
- Who are our major customers?

CRM would only be able to answer all these questions if the sales data is entered into the CRM system. Let us consider a manufacturer who sells its products through retailers. The order details would provide only retailers data and not the customer data. If the manufacturer wants to get customer data, a CRM is required that would capture the required information about the customers from the point of sale (POS). It is not hard to see though that this level of integration would be difficult to achieve. Each retailer may use the manufacturer's system directly or installs a system that provides data to the manufacturer. In both the cases, the reliance on the communication network is heavy. The security and privacy issues also surface in the first case. In the latter case, retailers wish to share the data and the data compatibility are the issues to be dealt with. Customers may not always be willing to provide their details.

If manufacturer sells through wholesalers, there is no way to get customer data from sales orders.

Why would manufacturer ask the above questions? If loyal and major customers are known, certain schemes may be launched for these customers. It is well established that retaining a loyal customer is much less expensive than acquiring a new customer. All the questions that are raised so far can provide valuable information to the middle- and the high-level management. They can use this information to adapt their business strategy. The management can get a consolidate picture from CRM and analyse their performance. Some of the sample questions that may help the management are the following:

- What are the characteristics of our customers?
- Are there certain types of customers who stay away from us?
- Are there certain types of customers who are price sensitive?
- Are there certain products that customers with specific characteristics buy?
- Can we adapt our marketing strategy to reach out to more customers?
- Do we need to move from mass marketing to individual marketing?
- Is our marketing strategy cost effective?
- Has the customer characteristics changed in last one year?
- Should we expect change in customer characteristic in next six months?

These questions can be answered by data mining the customer data and specify the

purchase they made. The organization may adapt their business strategy based on the answer to these questions.

10.5 DATA WAREHOUSE

A data warehouse is subject-oriented, integrated, time-variant and *non-volatile collection of data used in support of management decision-making process*. Data stored in a data warehouse is used by knowledge workers for strategic decision making.

Data warehouse is used to organize data in terms of subjects such as customer or product (subject oriented). Recall that the database associated with an ERP system stores operational and transactional data of company's ongoing operations. Data mart is a specialized version of data warehouse where data is stored for a specific purpose. One can create multiple data marts from a data warehouse and a union of many data marts would result in a data warehouse. The data for data warehouse may come from company's database, external sources such as competitor's reports, marketing agency's reports which is then integrated and kept in the data warehouse (integrated). The data in the data warehouse is associated with time, and as the new data is brought in, the old data is archived (time-variant). Consequently, one can ask questions such as what was the sale of item-A during first quarter in the north zone in year 2010. The data once put in the data warehouse is never modified (read only) that makes the data non-volatile. The data may be removed after it has attained certain pre-specified age. For instance, the data older than four years may be deleted from the warehouse and new data may be brought in. The grain size may be a month or three months.

The relational database management systems record organizational transactions whereas data warehouse supports and facilitate management-level decision making. Data warehouse is created to facilitate and support management level decisions that are based on historical data. For instance, management may decide to analyse sales data of the organization. It is not hard to see that historical data spanning over from few months to few years would be required. Management would like tools that are easy to use and virtually require no training to render the required data in required format. A data warehouse is characterized by the following:

- The data warehouse is for strategic decision making.
- The warehouse data is integrated.
- The warehouse contains historical data over long time horizon.
- The warehouse data is oriented around various subjects.
- The warehouse data is mainly read-only with periodic batch updates from operational data sources.
- The data warehouse contains data with several levels of details such as current details data, old detail data, lightly summarized data and highly summarized data.
- The data warehouse is characterized by and optimized for read-only transactions.
- One of the popular architecture for data warehouse is a three-tier architecture.
- The applications that run on a data warehouse include OLAP, data mining tools and query tools.

Let us look at the architecture of a data warehouse.

10.5.1 Architecture of Data Warehouse

The most popular architecture for a data warehouse consists of three layers referred to as three-tier architecture. The layers are as follows:

- Application layer
- OLAP server
- Data warehouse

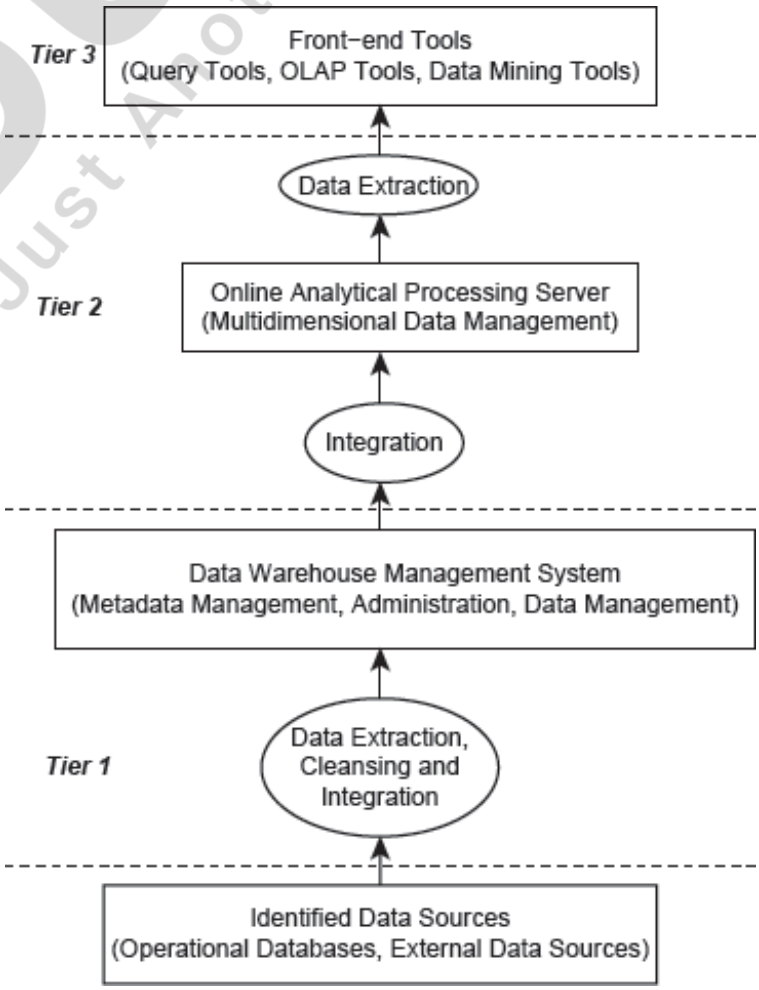
The architecture is shown in Figure 10.4. The figure shows only the data flow from lower layers to higher layers.

The application layer consists of application tools that are categorized as follows:

- Data mining tools
- OLAP tools
- Query tools
- Graphic tools

Data mining tools are discussed in Section 10.6. OLAP supports roll up and drill down operations for providing consolidated view and detailed view of the data, respectively. For example, one may have a view that shows sales data for each zone, each quarter and each product category. A drill-down view may show data for each product in selected category or for each month in selected quarter. The data may be shown as a labelled cube or a table.

FIGURE 10.4 Three-tier Architecture for Data Warehouse



OLAP server receive requests and provides multidimensional data to the application layer tools. OLAP server is optimized to answer queries using multidimensional data. OLAP server extracts data from the layer below, aggregates it and organizes it to optimally answer the queries expected from the application layer.

The data warehouse layer is responsible for extracting, cleaning and integrating the data from the layer below. The data in this layer is generally stored in RDBMS. This layer is also responsible for retiring the old data and bringing in the new

data.

10.5.2 Process of Creating a Data Warehouse

The steps involved in the data warehouse design are the following:

1. **Identify data sources and data acquisition policy:** The data for data warehouse may come from company's database, external sources such as competitor's reports, marketing agency's reports which is then integrated and kept in the data warehouse. The decision about the sources should be made, based on the requirements. The person/team/department responsible for providing the data should also be identified and told about the data required. The frequency for receiving the data and the medium for the data should also be decided and communicated.

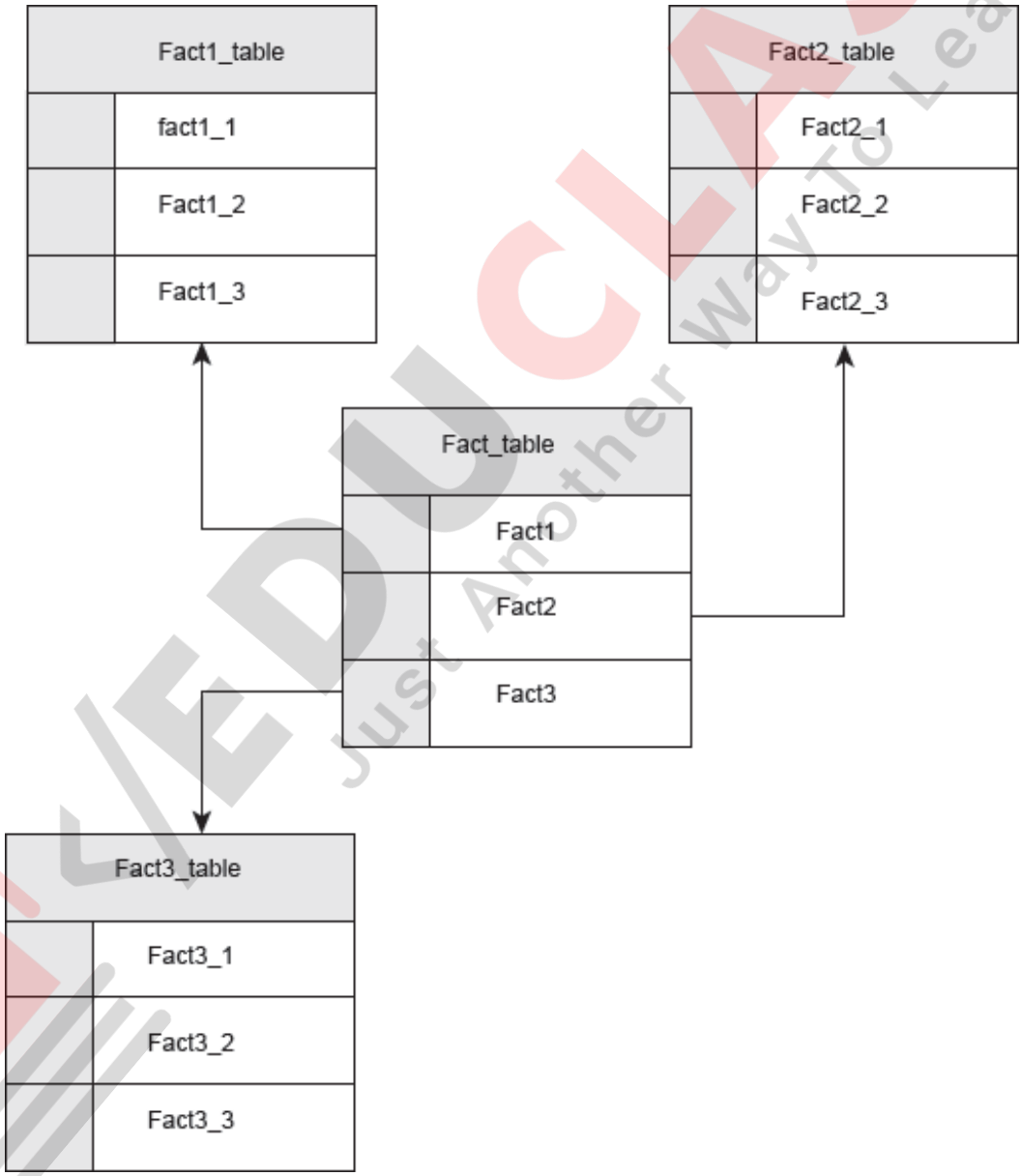


FIGURE 10.5: Star Schema for Data Warehouse

2. **Data warehouse design:** Data warehouse has to be designed in just the same way a relational database system is designed to meet the objective of the system. The following two schema are used for representing data in a warehouse:
   – Star Schema

– Snow Flakes Schema

Figure 10.5 shows a generic star schema. The *fact_table* is where the aggregated data is kept. This table where all the data is stored is referred to fact table. The *fact1_table* and *fact2_table* store information about the attributes *fact1* and *fact2*, respectively. These tables are referred to as dimension tables. The fact table is the largest where all the data is, and the dimension tables are much smaller. The snow flakes schema is a generalization of star schema where the dimension tables may also have dimension tables.

3. **Data cleansing:** The data from the data warehouse is primarily viewed in an aggregated manner and for making decisions. Therefore, it is essential that the data in the warehouse is complete, accurate and error free. To ensure these qualities, data cleansing is done. You may recall that data comes from different sources. It is a challenge to achieve aforementioned properties of the data. Just think of all the nulls that are found in the database or different representation/coding of the same data, missing data and incomplete data. If data is also coming from flat files, there may be additional challenges to handle. There are rule-based tools for data cleansing where rules may be defined by the users.
4. **Data aggregation:** The data sources have detailed data (transactional level) that is not appropriate for data warehouse. Some amount of data aggregation would have to be done. The challenge is to know the appropriate level of the aggregation. If transactional data is kept in the warehouse, aggregated queries would be expensive. If considerable aggregation is done, some of the queries may not get supported by the data warehouse. Pareto's 80/20 rule can be applied to optimize the data for 80 per cent of the queries. The data from different sources must appear integrated to the user. One approach is to virtually integrate databases and data sources through an intermediate system that would take a query from the user, create individual queries for all databases and data sources, collect results, integrate the results and present it to the user. The intermediate systems that facilitate virtual integration are known as wrappers and integrators. This style of integration is very inefficient. Another option is to integrate data from all sources and organize it in one unified relational database. There are products in the market built around both the approaches. The solutions built on the wrappers and integrators exploit parallelism. The solutions that first integrate, then populate the data warehouse take advantage of the offline nature of data aggregation activity.

10.6 DATA MINING

Data mining is non-trivial extraction of information from the data. The information that is extracted from the data is implicit which was previously unknown and potentially useful. The information cannot be extracted using a query. Data mining is not querying the database. Human interaction is also an integral part of data mining. Data mining overlaps with the following:

- Machine learning
- Neural networks
- Genetic algorithms

- Clustering, segmentation and statistical techniques

The main objective of data mining is to discover the unknown patterns and present them in human comprehensible form. The issues in creating data warehouse are already discussed in Section 10.5. Data mining techniques are used when the data is large and may run into tera bytes. One of the essential requirements of data mining algorithms is efficiency and scalability. Data mining algorithms are semiautomatic in nature. The objective of a data mining algorithm could be the following:

Discover association rules: One of the popular terms used is market-basket analysis to discover associations and the following are a few sales data described:

- Milk, bread, juice
- Milk, juice
- Milk, eggs
- Bread, biscuits, coffee

The association rules mining would attempt to discover patterns and associations in sales. One option is to build all possible combinations of two items, three items, etc. and find out if some of these combinations are bought more frequently, and frequently enough to make us conclude that these items are actually bought together. In the above sample data, one can discover that milk and juice are bought together. The organization may use this information to offer a special discount or place these items in the store strategically. There are parameters such as confidence and support to discard rare patterns and discover frequent patters.

Build classification hierarchies: As an example, a computer company wants to find out the characteristics of customers who are likely to buy a computer. The company has the past sales data. They can now use a classification algorithm to divide the sales data into non-overlapping classes of customers based on their characteristics. The algorithm will start by dividing customers into classes based on some characteristic and check if the classes created are acceptable. The algorithm learns as it progresses to arrive at an acceptable classification hierarchy. Many statistical and information theory concepts are used to evolve the hierarchy. The company can then use the characteristics of the customers for preparing their marketing strategy.

Discover sequential patterns: Data mining can also help in discovering sequential patterns hidden in the data. For example, someone buys a camera, followed by an extra lens and then a memory card. These patterns once discovered can help the organization to decide their marketing strategy. E-commerce sites use this knowledge to make recommendations and send recommendation e-mails. The pattern associated with single item can also be discovered such as performance of a stock or market trends for a company. This knowledge can be used to make stock purchase decisions or forecast the demand.

There are many other techniques to analyse data and discover interesting patterns in the data. The discussion of data mining techniques is not exhaustive. Efficiency and scalability are the two main concerns of data mining algorithm. A new set of algorithms are being developed which analyse the data when it is generated, such as network traffic without

storing the data. These algorithms are known as data streaming algorithms. Data mining is a relatively a new field and is developing fast. Business Intelligence (BI) is the latest field that aims to analyse the data for making business decisions.

CONCLUSION

In this chapter, some of the technologies related to ERP systems are learnt. An ERP system holds the organizational and transactional data. The related technologies help the organization to integrate customers using CRM and suppliers using SCM. ERP, SCM and CRM together are referred to as ERP-II. The available data is a rich source of information. There are techniques for analysing data to improve decision-making process. Data warehouse is the technology that transforms the transactional data into the form that is used for analysis. The analysis technology and techniques together are referred to a as data mining.

EXERCISES

Check Your Understanding

1. What is electronic data interchange?
2. What role does supply chain management (SCM) play in an organization? Explain SCM. How does SCM integrate with ERP?
3. What is customer relationship management (CRM)? Who are the users of a CRM system?
4. Explain data warehouse. What are the challenges in creating a data warehouse? What is the usage of a data warehouse?
5. Briefly describe data mining. What are various kinds of analysis done by data mining algorithms?

Apply Your Understanding

1. Find out how an organization shares data with another organization? Is it electronic data interchange or other mechanism? You may conduct a survey and do a web search.
2. Find out the commercial supply chain management (SCM) software. Does your organization use a SCM package?
3. Customer relationship management (CRM) is still a new technology. Do a survey to locate some companies that use CRM? What are the commercial CRM packages?
4. Visit some departmental stores to observe the purchase patterns of the customers. Do they seem to buy some items together? Are these items placed close by in the store?