Chapter1

The Emergence of the Digital World

PD predicted that information and IT would become increasingly important

- Knowledge Society
  -- Knowledge economy, digital society, network era, the Internet era, digital world, information age, etc.
  -- Processing knowledge would be as important as (or even more important than) other resources (land, labor, and capital)
- Knowledge Worker
  -- Typically professionals who are relatively well educated and who create, modify, and/or synthesize knowledge as a fundamental part of their jobs
  -- Generally paid better than their prior agricultural and industrial counterparts

Five Trends of the Digital Future

Mobile, Social Media, Internet of Things, Cloud Computing, Big Data

Innovative Business Models

Sharing Economy / Service-oriented Business Models (Servitization)

Ethical Issues in the Information Age: Privacy / Accuracy / Property / Accessibility

Information System: Combination of people and information technology that create, collect, process, and distribute useful data

IT Resources	Non - IT Resources
Hardware	Data
Software	People

Chapter 8 Enterprise Systems

Evolution of Enterprise Systems

Internally focused systems

- Support functional areas, business processes, and decision making within an organization.
- Enterprise Resource Planning (ERP): Integrates business activities across department boundaries, including planning, manufacturing, sales, marketing, etc.

Externally focused systems

- Coordinate business processes with customers, suppliers, business partners, and others who operate outside an organization's boundaries
- Customer Relationship Management (CRM)
    - Concentrates on activities involved in promoting and selling products to customers as well as providing customer service and nourishing long-term relationships
- Supply Chain Management (SCM)
    - Integrates the value chains of business partners within a supply chain, improving the coordination of suppliers, product or service production, and distribution

ERP Core Function

Capability	Explanation
Financials	Allows organizations to manage corporate finance functions by automating financial supply chain management, financial accounting, and management accounting
Human capital management	Gives organizations the tools needed to maximize the profitability potential of the workforce, with functionality for employee transaction management and employee life cycle management
Operations	Empowers organizations to streamline operations with integrated functionality for managing end-to-end logistics processes while expanding collaborative capabilities in supply chain management, product life cycle management, and supplier relationship management
Corporate services	Allows organizations to optimize centralized and decentralized services for managing real estate, corporate travel, and incentives and commissions

SAP ERP Modules

Benefits

Improved availability of information	Reduced operating expenses
Increased interaction throughout the organization	Reduce IS costs
Improved (reduced) lead times for manufacturing	Improved supplier integration
Improved customer interaction	Improved compliance with standards, rules and regulations

Costs

Travel and training costs for personnel	Business process studies
Ongoing customization and integration costs	Project governance costs

Redesign is the main cost problem

Business Process Management (BPM)

A systematic, structured improvement approach by all or part of an organization whereby people critically examine, rethink, and redesign business processes in order to achieve dramatic improvements in one of more performance measures, such as quality, cycle time, or cost

Business Process Reengineering (BPR): The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed. Encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human, and organizational dimensions.

Business Process Improvement (BPI): A systematic approach to help an organization optimize its underlying processes to achieve more efficient results. Less radical. Less disruptive, more incremental for radical change.

Information systems are the key enabler for radical change.

BPI vs BPR

	BPI	BPR
Level of Change	Incremental	Radical
Process Change	Improved new version of process	Brand new process
Starting Point	Existing processes	Clean slate
Frequency of Change	One-time or continuous	Periodic one-time change
Time Required	Short	Long
Typical Scope	Narrow, within functions	Broad, cross functional
Horizon	Past and present	Future
Participation	Bottom-up	Top-down
Path to Execution	Cultural	Cultural, Structural
Primary Enabler	Statistical control	Information technology
Risk	Moderate	High

IBM Credit

The original process - A sales representative called in with a request for financing. An operator in the central office wrote down the request.--The request was then dispatched to credit department to check the customer’ s credit status.--The business practices department modified the standard

loan covenant in response to the request.--The pricing department determined the appropriate interest rate.--The administration department turned all the information into an quote letter which was then delivered to the sales representative by FedEx.

Problems: The entire process took 6 days on average (up to 2 weeks). Customers could be seduced by other computer vendor or simply called the deal off. / When the sales representative called, no one could tell where the request was and when it could be done.

Solution 1: Automating and improving the process

- Install a control desk to answer the status of the request.
- The request was returned to the control desk after each step, logged the competition, and forwarded to the next step.
    - Sophisticated queuing theory and linear programming used to balance workloads and staff.
    - Performance standards were introduced for each department.

Problems:

- Process time got worse, even though each department achieved almost 100% compliance on its performance.
- The actual work only took 1.5 hours (90 minutes).
- The remaining time was wasted on handling the forms off from one department to the next.

Solution 2: Reengineer the process

- Replaced the specialists (credit checkers, pricers, etc.) with generalists (deal structurers) to processes the entire request from beginning to end.
- Decision support systems were developed to guide deal structurers and provide rapid access to all key information.

Results:

- Process time reduced by 90% (from 6 days to 4 hours).
- Process volume increased by 100 times (10,000%).
- No increase in head count (even a small head count reduction).

Basic Steps in BPM:

› Develop a vision for the organization that specifies business objectives
    - Reducing costs, shortening the time it takes to get products to market, improving quality of products and/or services, etc.
› Identify and critical processes that are to be redesigned
› Understand and measure the existing processes as a baseline for future improvements
› Identify ways that information systems can be used to improve the processes
› Design and implement a prototype of the new processes

Reading

1. What are legacy systems? 什么是遗留系统

Older stand-alone computer systems within an organization with older versions of applications that are either fast approaching or beyond the end of their useful life within the organization.

Legacy system approach: Separate information storage files for different business activities.

Traditionally, companies are organized around functional areas, however, most business processes cross the boundaries of business functions. More helpful to think in terms of business processes from a customer’ s (both internal and external) point of view

2. What is the problem of using legacy systems for managing enterprise resources? 用遗留系统管理企业资源的问题有什么

(1) Information silos 信息孤岛

Information is spread across dozens or even hundreds of separate computer systems, each housed in an individual function, business unit, region, factory, or office

(2) Fragmented systems 分散的系统

Costs for storing and rationalizing redundant data, rekeying and reformatting data, updating and debugging, programming communication links between systems, etc.

(3) Fragmented business 分散的业务

Operations based on fragmented processes / Decisions based on fragmented information

Unmodified legacy systems carry some baggage. For one thing, they require a significant amount of upkeep. Hardware maintenance only gets more expensive as equipment ages, especially in comparison to cloud storage. Vendor support may end when it falls out of common usage.

Even when legacy software is still supported, it may be unmanageably complex. Legacy systems tend to be massive monoliths with large code bases and poor documentation. Besides the added maintenance burden, complexity discourages developers from experimenting with new technology because even small changes could cascade into larger problems. It’ s also harder to find qualified technicians to work with outdated technology.

All these issues contribute to the main problem with legacy systems: they’ re expensive. The cost drains resources from other business projects—but it doesn’ t have to. There are ways to modify legacy systems into something more compatible with modern technology.

3. What are the direct and indirect costs associated with the problem? 与这个问题相关的直接和间接成本是什么?

Maintain the system will have a direct cost which involves storing and rationalizing redundant data, for rekeying and reformatting data from one system for use in another, for updating and debugging obsolete software code, for programming communication links between systems to automate the transfer of data. However, the more important one is about the indirect cost which will be a hinder between sales and marketing systems, as well as the management. The author said: "If a company’ s systems are fragmented, its business is fragmented."

4. How do enterprise systems address the problem? 企业如何处理这个问题

(1) A good ES is a technological tour de force. The core is **A single comprehensive database that collects data from and feeds data into modular applications supporting virtually all of a company’ s business activities**—across functions, across business units, across the world. When new information is entered in one place, related information is automatically updated.

(2) An ES streamlines a company’ s data flows and provides management with direct access to a wealth of **real-time operating information**. For many companies, these benefits have translated into **dramatic gains in productivity and speed.**

5. What is the core component of an enterprise system? 企业系统的核心组件是什么

6. What is the main reason enterprise systems fail? 企业系统失败的主要原因是什么

› Profoundly complex software, large investment of money, time, and expertise are not the biggest problems

› Failure to reconcile the technological imperatives of the enterprise system with the business needs of the enterprise itself

-Install an enterprise system without first having a clear understanding of the business implications

› An enterprise system, by its very nature, imposes its own logic on a company’ s strategy, organization, and culture

-It pushes a company toward generic processes even when customized processes may be a source of competitive advantage

-It pushes a company toward full integration when a certain degree of business unit segregation may be in its best interests

-The logic of the system conflicts with the logic of the business

Some of the blame for such debacles lies with the enormous technical challenges of rolling out enterprise systems—these systems are profoundly complex pieces of software, and installing them requires large investments of money, time, and expertise. But the technical challenges, however great, are not the main reason enterprise systems fail. The biggest problems are business problems. Companies fail to reconcile the technological imperatives of the enterprise system with the business needs of the enterprise itself.

If a company rushes to install an enterprise system without first having a clear understanding of the business implications, the dream of integration can quickly turn into a nightmare. The logic of the system may conflict with the logic of the business, and either the implementation will fail, wasting vast sums of money and causing a great deal of disruption, or the system will weaken important sources of competitive advantage, hobbling the company.

When developing information systems in the past, companies would first decide how they wanted to do business and then choose a software package that would support their proprietary processes. They often rewrote large portions of the software code to ensure a tight fit. With enterprise systems, however, the sequence is reversed. The business often must be modified to fit the system.

7. “SAP isn’ t a software package; it’ s a way of doing business.” What does that mean? 如何理解“SAP 不是软件包，而是做生意的方法”

Some degree of ES customization is possible. Because the systems are modular, for instance, companies can install only those modules that are most

appropriate to their business. However, the system’ s complexity makes major modifications impracticable. As a result, most companies installing enterprise systems will need to adapt or even completely rework their processes to fit the requirements of the system. An executive of one company that has adopted SAP’ s system sums it up by saying, **“SAP isn’ t a software package; it’ s a way of doing business.”**

8. What are the two main mechanisms used to customize an enterprise system? 定制企业系统的两种主要机制是什么?

9. What is impact of enterprise systems on a company’ s organization structure and culture? 企业系统对公司组织结构和文化有什么影响?

(1) Universal, real-time access to operating and financial data allows companies to streamline their management structure

-Flatter, more flexible, and more democratic organizations

-Decentralized organizational structure

(2) Centralization of control over information and the standardization of processes

-Hierarchical, command-and-control organizations with uniform cultures

-Centralized organizational structure

› Support opposite organizational goals

-Break down hierarchical structures, freeing people to be more innovative and more flexible

-Exert more management control and impose more uniform processes

› Global uniformity vs. local autonomy

-How much uniformity should exist in the way it does business in different regions or countries?

-Introduce more consistent operating practices across the geographically dispersed units

-Differences in regional markets remain so profound that strict process uniformity would be counterproductive

› Federalist operating model

-Roll out different versions of the same system in each regional unit, tailored to support local operating practices

-To preserve local autonomy while maintaining a degree of corporate control

-What should be commonly implemented through the organization? What should be allowed to vary?

10. What is the federalist model approach to enterprise systems implementation? 什么是企业系统实现的联邦模型方法?

11. Describe the organizational changes by Elf Atochem in the implementation of the new enterprise system. 描述该公司在实施新的企业系统过程中的组织性变化

Fundamental changes to organizational structures – Not just computer systems

- Combining all accounts-receivable and credit departments into one function → consolidated each customer’ s activities into one account
- Combining all unit’ s customer-service departments → gave customers one contact point

Create competitive advantage with the enterprise system

- The system generated the real-time information necessary for connecting sales (demand) and production planning (supply)
- As orders enter or change, the system updates forecasts and factory schedules
- Production runs shift quickly based on customer needs. Only one other company has the capability.

12. Describe the implementation strategy by Elf Atochem in the implementation of new enterprise system. 描述该公司在实施新的企业系统过程中的实施策略

› Put the right people in place

- Computer systems without the right people don’ t change organizational behavior
- A new demand manager position to orchestrate sales and production planning
- Salespeople can guarantee orders six weeks ahead of production

› Implement the system gradually

- Unit-by-unit rollout
- Installed the system one business units at a time
- Large and broadly representative implementation team (60 persons)
- Business analysts, information technologists, “super users” representing different business units and corporate functions
- The large and broadly representative implementation team and unit-by-unit rollout enabled staffing the effort mainly with insiders
- Reduced implementation costs and boosted employees’ understanding of the system

13. What is the fundamental problem enterprise systems are designed to solve? 企业系统要解决的基本问题是什么?

Companies that have the biggest problems are those that install an enterprise system without thinking though its full business implications.
Clarify strategic and organizational needs – and business implications of integration – before implementing.

Chapter 9 Enterprise Systems

1. What is the bullwhip effect? 什么是牛鞭效应

Demand order variabilities in the supply chain were amplified as they moved up the supply chain.

“牛鞭效应”其实是在下游企业向上游企业传导信息的过程中发生**信息失真（Distorted information）**，而这种失真被逐级放大的结果，从而波及

到企业的营销、物流、生产等领域。牛鞭效应成因于系统原因和管理原因，它们的共同作用提高了企业经营成本，对产品供应链造成消极影响，导致对市场变化的过激反应。

2. What happens when a supply chain is plagued with the bullwhip effect? 当供应链被牛鞭效应困扰会发生什么

Distorted information from one end of a supply to the other can lead to tremendous inefficiencies

- Excessive inventory investment -- 库存
- Poor customer service -- 客户服务
- Lost revenues -- 利润变少
- Misguided capacity plans -- 生产计划误导
- Ineffective transportation -- 低效运输
- Missed production schedules -- 生产计划

3. How do exaggerated order swings occur? 牛鞭效应原因

(1) Demand Forecast Updating 预测需求但是不准确

Forecasting is often based on the order history from the company's immediate customers

(2) Order Batching 订单间隔不准确 无法得到准确预测

Company often batches or accumulates demands before issuing an order

Periodic ordering - Order weekly, biweekly, or even monthly

- Because the time and cost of processing an order can be substantial

Push ordering - Salespersons who need to fill sales quotas may "borrow" ahead and sign orders prematurely

(3) Price Fluctuation 价格波动

Price discounts, quantity discounts, coupons, rebates and so on.

Forward buy arrangement - Items were bought in advance of requirements, usually because of a manufacturer's attractive price offer

(4) Rationing and Shortage Gaming 需求和供应之间的博弈

When the product is in short supply, customers exaggerate their real needs when they order.

4. What can companies do to mitigate them? 企业做什么可以减轻这些问题？

(1) Avoid Multiple Demand Forecast Updates

- Make demand data at a downstream site available to the upstream site
- Both sites can update their forecasts with the same raw data

(2) Break Order Batches

- Reduce the cost of placing an order and replenishing it

(3) Stabilize Prices

- Reduce both the frequency and the level of wholesale price discounting

(4) Eliminate Gaming in Shortage Situations

- Sharing sales, capacity, and inventory data
- Allocation based on past sales instead of orders when in shortage

(5) Build Strategic partnership

(6) Optimize operation flow

5. What are the underlying coordination mechanisms behind various initiatives? 各种倡议背后的基本协调机制是什么？

(1) Information Sharing 信息共享

- Demand information at a downstream site is transmitted upstream in a timely fashion

(2) Channel Alignment 供应链渠道对接

- Coordination of pricing, transportation, inventory, and ownership between the upstream and downstream sites in a supply chain

(3) Operational Efficiency 高效运营

- Activities that improve performance, such as reduced costs and lead time

Causes	Information Sharing	Channel Alignment	Operational Efficiency
Demand Forecast Update	• Understanding system dynamics • Use point-of-sale (POS) data • Electronic data interchange (EDI) • Internet • Computer-assisted ordering (CAO)	• Vendor-managed inventory (VMI) • Discount for information sharing • Consumer direct	• Lead-time reduction • Echelon-based inventory control
Order Batching	• EDI • Internet ordering	• Discount for truck-load assortment • Delivery appointments • Consolidation • Logistics outsourcing	• Reduction in fixed cost of ordering by EDI or electronic commerce • CAO
Price Fluctuations		• Continuous replenishment program (CRP) • Everyday low cost (EDLC)	• Everyday low price (EDLP) • Activity-based costing (ABC)
Shortage Gaming	• Sharing sales, capacity, and inventory data	• Allocation based on past sales	

6. What is electronic data interchange? How does it address the bullwhip effect? 什么是电子数据交换？ 它是如何处理牛鞭效应的？

使用电子数据交换系统（EDI）对销售情况进行适时跟踪是解决“牛鞭效应”的重要方法，如 DELL 通过 Internet、Intranet、电话、传真等组成了一个高效信息网络，当订单产生时即可传至 DELL 信息中心，由信息中心将订单分解为子任务，并通过 Internet 和企业间信息网分派给各区域中心，各区域中心按 DELL 电子订单进行组装，并按时间表在约定的时间内准时供货（通常不超过 48 小时），从而使订货、制造、供应“一站式”完成，有效地防止了“牛鞭效应”的产生。

It uses computer-to-computer communication standards (without human intervention) and allows companies to do computer-assisted ordering (CAO)

7. What is vendor-managed inventory (VMI)? How does it address the bullwhip effect? 什么是供应商管理库存（VMI）它是如何处理牛鞭效应的？

(1) Suppliers to a manufacturer (or retailer) manage the manufacturer’ s (or retailer’ s) inventory levels based on pre-established service levels

(2) The manufacturer (or retailer) allows the supplier to monitor stock levels and ongoing sales data

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Supply Chain

A collection of companies and processes involved in moving a product from the suppliers of raw materials to the suppliers of intermediate components, then to final production, and ultimately, to the customer

Upstream activities

- Procuring raw materials and components from many different suppliers

Internal activities

- Packaging, assembly, or manufacturing

Downstream activities

- Moving products to many different customers

Supply Chain Management (SCM)

(1) Improves interorganizational business processes in **B2B relationship**

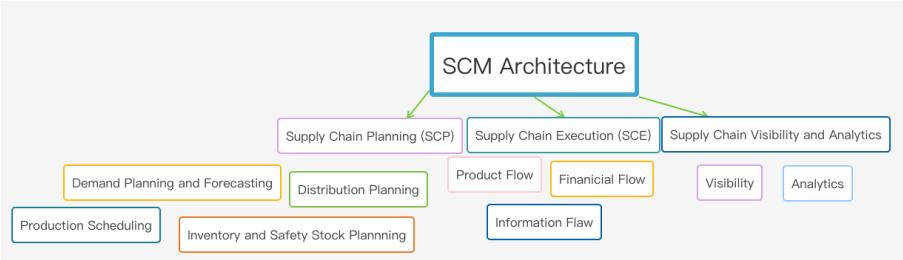
- Coordination of suppliers, product or service production, and distribution

(2) Objectives

- Accelerate **product development**
- **Reduce costs** with procuring raw materials, components, and services from suppliers

(3) Often integrated with **ERP** to leverage internal and external information in order to better collaborate with suppliers

SCM Architecture



SCP: Involves the development of various resource plans to support the efficient and effective production of goods and service

SCE: Puts the SCM planning into motion and reflects the processes involved in improving the collaboration of all members of the supply chain

SCVA: Visibility: Ability to track products and they move through the supply and to foresee external events

Analytics: Use of key performance indicators to monitor performance of the entire supply chain, including sourcing, planning, production, and distribution

Developing a successful SCM Strategy 效率&有效性

Requires balancing supply chain **efficiency** and **effectiveness**

Supply Chain Efficiency:

The use of resources in its supply chain extent to which a company optimizes the activities.

Companies that pursue a low-cost competitive provider strategy.

Supply Chain Effectiveness:

The extent to which a company' s supply activities meet the requirements of the external partners involved

Companies that pursue superior customer service as a differentiation strategy.

Key Technologies for Enhancing SCM

Extensible Markup Language (XML)

- A data presentation standard for the web
- Allows designers of Web documents to create their own tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations

Extensible Business Reporting Language (XBRL)

- An XML-based specification for publishing financial information
- Makes it easier for public and private companies to share financial information with each other, with industry analysis, and with shareholders

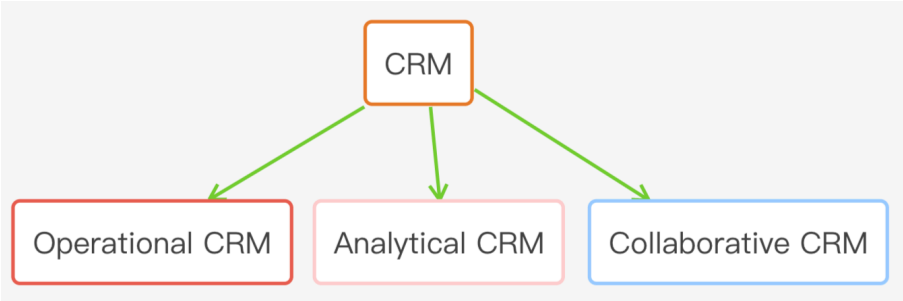
Radio Frequency Identification (RFID)
- The use of electromagnetic energy to transmit information between a reader (transceiver) and a processing device, or RFID tag
- Starting to replace standard bar codes (Eliminates the need of line-of-sight reading / Greater distances and relatively inexpensive)

Customer Relationship Management (CRM)

CRM is not simply a technology, it is a corporate-level strategy, through the introduction of reliable systems, processes and procedures, to create and maintain lasting relationships with customers by concentrating on downstream information flows. Nowadays, empowered customers have many ways to obtain and spread information and opinions about companies, and companies also search for ways to widen, lengthen, and deepen customer relationships. It pursues customer satisfaction as a basis for achieving competitive advantage.

3 main objectives:

Attract potential customers / Create customer loyalty / Portray positive corporate image 潜在客户/客户忠实度/企业形象



运营型 CRM，分析型 CRM，协作型 CRM

Operational CRM

- Systems for automating the fundamental business process – marketing, sales, and support – for interacting with customer

Enable direction interaction with customers

Aids in the execution of CRM Strategy

- Sales Force Automation / Customer Service and Support / Enterprise Marketing Management

Analytical CRM

- Systems for analyzing customer behavior and perceptions (e.g., quality, price, and overall satisfaction) in order to provide business intelligence

Provides the analysis necessary to more effectively manage the sales, service, and marketing activities

Aids in the development of CRM strategy

- Analyzing customer behavior and perceptions / Enhancing a broad range of customer-focused business processes
- Key technology: Data warehouses / Data mining and visualization / Business Intelligence

Operational CRM

- Systems for providing effective and efficient communication with the customer from the entire organization

Provides the communication capabilities of the CRM environment

- 3 ways: Greater customer focus / Lower communication barriers / Increased information integration

Developing a Successful CRM Strategy

(1) Policies and Business Processes – reflect a customer-focused culture

(2) Customer Service – reflect customer-focused measures for quality and satisfaction (key metrics) / processes change to enhance customer experience

(3) Employee Training – have a consistent focus that values customer service and satisfaction

(**4) Data Collection, Analysis, and Sharing** – all aspects of the customer experience (prospecting, sales, support) must be tracked, analyzed, and shared.

Chapter 10 Business Intelligence, Big Data and Analytics

The importance of BI

BI: Tools and techniques for analyzing and visualizing past data

Analytics: Tools and techniques used to understand why something happened, predict future outcomes, or discover hidden patterns in large data sets. The use of math and statistics to derive meaning from data in order to make better business decisions

- Descriptive analysis: 描述性分析 Tell you what happened in the past, but not why it happened, or what might change
- Predictive analysis: 预测分析 Use past data to model future outcomes, like how customers will respond to a marketing promotion, how sales will be affected by certain market conditions, etc.
- Prescriptive Analytics: 优化分析 Use techniques like optimization or A-B testing to advise managers and workers on how best to do their jobs

Combining big data with effective analytics is a key competitive advantage for organizations

Big data: Vast volumes and types of information that companies can now collect and process using increasingly high-tech systems

Big data characters: High volume (Storing and managing increasing amounts of data poses tremendous challenges) | **High variety** (structured data, unstructured data and semi-structured data) | **High velocity** (Organizations have to process and use the data even more quickly)

Data-driven organizations: make decisions that can be backed up with verifiable data. Better respond to ongoing threats and opportunities, such as Globalization, competitive pressures, consumer demands, societal changes, governmental regulations, and better plan for the future. Decision

making can be pushed lower into the organization, freeing up senior management time for more important decisions.

BI Architecture

Operational System: Systems used to interact with customers and run a business in real- time.

Online Transaction Processing systems (OLTP): Operational systems designed to handle multiple concurrent transactions from customers

Extraction, Transformation, Loading (ETL): Process for consolidating data from operational systems with other organizational data

Data warehouse: a single repository of historical data for analysis and reporting

Data mart: a data warehouse that is limited in scope and customized for the decision support needs of a particular end-user group

BI and advanced analytics tools

Decision Support Systems

Online Analytical Processing

Dashboards

Data Mining (Classification, Estimation, Clustering, Association Discovery, Text mining, web mining)　分类|估计|聚类|关联发现|文本挖掘|web 挖掘

Decision Support Systems (DSS)

A special purpose information system designed to support organizational decision making related to a particular recurring problem. Used by managerial-level employees to help them solve semi-structured problems (problems that require a combination of standard solution procedures and individual judgment or some procedures to follow for a given situation can be specified in advance). **Employ mathematical models** (simplified representations, or abstractions, of reality). **Designed to be an interactive decision aid.**

能做什么: what-if analysis, goal-seeking analysis, sensitivity analysis, optimization models

What-if Analysis

- How hypothetical changes in inputs influence the results

Goal-seeking Analysis

- How input parameters need to be changed to achieve a desired end state

Sensitivity Analysis

- How different input values and their probability of occurring will impact the results of a model

Optimization Models

- Find the best balance between certain parameters within given constraints

Online Analytical Processing (OLAP):

The process of quickly conducting complex, multidimensional analyses of data stored in a database that is optimized for retrieval, typically using

graphical software tools. This deals with "what you want to see" and "how you want to see" problems.
OLAP Cube: Data structure allowing for multiple dimensions to be added to a traditional two- dimensional table
Slicing and Dicing: Analyzing the data on subsets of the dimensions
Dashboards: Present key performance indicators and other summary information used by managers and executive to make decisions.
Data Mining: Methods used by companies to discover "hidden" predictive relationships in data to better understand their customers, products, markets, or any other phase of their business for which data have been captured.
Two basic operations: Identifying previous unknown pattern | Predicting trends and behaviors
Applications: (Classification, Estimation, Clustering, Association Discovery, Text mining, web mining) 分类|估计|聚类|关联发现|文本挖掘|web 挖掘
Classification: Assignment a newly presented object to one of a set of predefined classes, used when groups are known 对人群分类
Classification Applications:
Identifying potential customers (prospects)
Classifying credit applicants as low, medium, or high risk
Spotting fraudulent insurance claims
Estimation: comes up with a value for some unknow continuous variable (income, order size, credit card balance) given some input data 预测
Estimation Applications:
Estimating the lifetime value of a customer
Estimating the probability that someone will respond to a marketing promotion
Determining which customers will leave within the next 6 months (churn)
Clustering: Grouping related records together on the basis of having similar values for attributes (age groups, income levels)
Clustering Applications:
Targeting certain groups of customers in marketing campaigns
New product development
Association Discovery: Find associations or correlations among sets of items (items typically purchased together)
Association Discovery Applications:
Redesign the store's layout and optimize the customers' "navigational path" though the store
Product recommendations / cross-selling / bundling
Text Mining: The use of analytical techniques for extracting information from textual documents

Text Mining Application:

Analyze email text to block spam

Analyze customer text comments

Identify documents of interest to users with specific profiles

Filter and match resumes to job postings by human resources

Web Mining: content / structure / usage mining

Web Content Mining	Analyze the content data (text,image,audio) available in web documents
Web Structure Mining	Analyze the underlying link (node,connection) structure of web documents
Web Usage Mining	Analyze web server logs to discover useful patterns of web user behavior

Sentiment analysis on customer reviews: The use of natural language processing, text analysis and computational linguistics to identify and extract subjective information in source materials. (Web Content Mining)

Link Analysis: a data-analysis technique used to evaluate relationships (connections) between nodes | Pagerank: Algorithm used by Google Search to rank websites in their search engine results (Web Structure Mining)

Social Network Analysis: A strategy for investigating social structures through the use of network and graph theories (Web Structure Mining)

Social Network Analysis Applications: Social marketing

Clickstream Analysis: Recording of the parts of the screen a computer user clicks on while web browsing or using another software application (Web Usage Mining)

Bank of America

Business Challenge: Improve the marketing of home equity loans

Applying Data Mining: Decision tree / Sequential pattern / Clustering

- Decision tree

Classify existing customers as likely or unlikely to respond to a home equity loan offer

Flagged as "good prospect for home equity lines of credit"

- Sequential pattern analysis

Discover a sequence of events that had frequently preceded successful solicitations in the past

Determine when customers were most likely to want a home equity

- Clustering

Segment the customers into groups with similar attributes

One of the 14 clusters had two intriguing properties
39% of the people in one cluster had both business and personal accounts
The cluster accounted for more than a quarter of the likely responders
- People might be using home equity loans to start businesses

10.1 Why are organizations competing on analytics today?

(2) It can dramatically boost their creators' revenues and reputations. These heralded—and coveted—applications amassed and applied data in ways that upended customer expectations and optimized operations to unprecedented degrees.

(3) At a time when firms in many industries offer similar products and use comparable technologies, business processes are among the last remaining points of differentiation. It' s virtually impossible to differentiate from competitors based on products alone - Rivals sell similar offerings / - Hard to beat overseas competitors (with cheap offshore labor) on product cost

(1) Business processes are among the last remaining points of differentiation: It' s virtually impossible to differentiate from competitors based on products alone

- Rivals sell similar offerings / - Hard to beat overseas competitors (with cheap offshore labor) on product cost

10.2 How do companies become an analytics competitor?

Become an analytics competitor: Use sophisticated data-collection technology and analysis to wring every last drop of value from all your business processes

- E.g., Not only what your customers want, but also how much they' re willing to pay and what keeps them loyal
- E.g., Not just track existing inventory, but also predict and prevent future inventory problems

10.3 Describe the three key attributes commonly found among analytics competitors

Widespread use of modeling and optimization: -Any company can generate simple descriptive statistics about aspects of its business—average revenue per employee, for example, or average order size. But analytics competitors look well beyond basic statistics.

An enterprise approach: -Analytics competitors understand that most business functions—even those, like marketing, that have historically depended on art rather than science—can be improved with sophisticated quantitative techniques.

Senior executive advocates: -A companywide embrace of analytics impels changes in culture, processes, behavior, and skills for many employees. And so, like any major transition, it requires leadership from executives at the very top who have a passion for the quantitative approach.

10.4 Give an example on how a financial company can use analytics to improve its business processes

› 1. Create a Single Analytics Initiative

- Place all data-collection and analysis activities under a common leadership

- E.g., **P&G** created a centrally managed "cyberanalytics" group of 100 analysts drawn from many different functions: Sales and marketing analysts supply data on growth opportunities in existing markets to supply analysts, who can then design more responsive supply networks

› 2. Champion Analytics from the Top

- Acknowledge and endorse the changes in culture, processes, and skills that analytics competition
- Prepare to **lead an analytics-focused organization**

Understand the theory behind and recognize the limitations / Consult experts who understand your businesses and know how analytics can be applied

› 3. Focus Your Analytics Effort

Channel your resources into analytics initiatives that most directly serve your
overarching competitive strategy

E.g., **Harrah's** aims at improving customer loyalty, customer service, and related areas such as pricing and promotions

› 4. Establish an Analytics Culture

- Instill a companywide respect for measuring, testing and evaluating quantitative

Evidence / - Urge employees to base decisions based on hard facts / - Gauge and reward performance the same way – applying metrics to compensation and rewards

› 5. Hire the Right People

- Possess top-notch quantitative-analysis skills / - Can express complex ideas in simple terms, and can interact productively with decisions makers

› 6. Use the Right Technology

- Prepare to spend significant resources on technology such as CRM or ERP systems
- No transaction or other significant exchange occurs without leaving a mark
- Present data in standard formats, integrate it, store it in a data warehouse
- Make data easily accessible to everyone
- Expect to spend years gathering enough data to conduct meaningful analyses
- E.g., **Dell** took 7 years to create a database that includes 1.5 million records of all its print, radio, broadcast TV, and cable ads / Couples the database with sales for each region in which the ads appeared (before and after their appearance) / Enables the company to fine-tune promotions for every medium in every region

10.5 Explain the difference between the traditional approach by companies and the enterprise approach by analytics competitors.

In traditional companies, departments manage analytics —number-crunching functions select their own tools and train their own people. But that way, chaos lies.

Analytics competitors treat all such activities from all provenances as a single, coherent initiative, often massed under one rubric, such as "information-based strategy" at Capital One or "information-based customer management" at Barclays Bank. These programs operate not just

under a common label but also under common leadership and with common technology and tools.

Chapter 11 IS Acquisition and Development

Making the business case for an information system

Faith: agree with organizational strategy, competitive advantage, industry forces, customer perceptions and market share

Fear: If the system is not implemented the firm will lose out to the competition or worse, go out of business

Fact: data, quantitative analysis(定量分析), indisputable factors (必然因素)

Cost-Benefit Analysis

Total Cost of Ownership (TCO): Total cost of acquisition and all costs associated with the ongoing use and maintenance of the system.

Non-recurring costs: One-time costs that are not expected to continue after the system is implemented: Site preparation, technology purchases, training, renovation - Recurring costs

Recurring costs: Ongoing costs that occur throughout the life of the system: Salary and benefits, electricity, upgrades and maintenance, monthly fees; Personal costs are usually the largest recurring costs.

Benefits: Tangible benefits / Intangible benefits

- Increase in sales due to increased customer reach
- Improvements in customer service

Net Present Value (NPV)

› Suppose the discount rate is 8%

› NPV of the project

$$= -\$4{,}500 + \frac{\$103{,}500}{(1.08)^1} + \frac{\$130{,}250}{(1.08)^2} + \frac{\$155{,}250}{(1.08)^3} + \frac{\$179{,}500}{(1.08)^4}$$

$$= -\$4{,}500 + \$95{,}833 + \$111{,}668 + \$123{,}242 + \$131{,}938$$

$$= \$458{,}182$$

		2014	2015	2016	2017	2018
Costs						
Non-recurring						
Hardware		$ 20,000				
Software		$ 7,500				
Networking		$ 4,500				
Infrastructure		$ 7,500				
Personnel		$100,000				
Recurring						
Hardware			$ 500	$ 1,000	$ 2,500	$ 15,000
Software			$ 500	$ 500	$ 1,000	$ 2,500
Networking			$ 250	$ 250	$ 500	$ 1,000
Service fees			$ 250	$ 250	$ 250	$ 500
Infrastructure				$ 250	$ 500	$ 1,500
Personnel			$ 60,000	$ 62,500	$ 70,000	$ 90,000
Total costs		$139,500	$ 61,500	$ 64,750	$ 74,750	$110,500
Benefits						
Increased sales		$ 20,000	$ 50,000	$ 80,000	$115,000	$175,000
Error reduction		$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Cost reduction		$100,000	$100,000	$100,000	$100,000	$100,000
Total benefits		$135,000	$165,000	$195,000	$230,000	$290,000
Net costs/benefits		$ (4,500)	$103,500	$130,250	$155,250	$179,500

Example2:

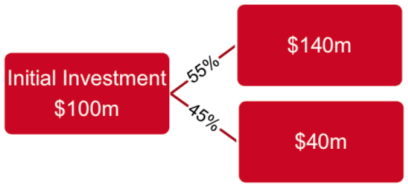
A company is looking to invest in new smart vending machines that will reduce costs and increase profits.

- A probability of 0.55 that there will be a high demand in this technology with a market value of $140m
- A probability of 0.45 that there will be a low demand in this technology with a market value of $40m

If the cost of investing in this technology at time zero is $100m and the discount rate is 8%

- NPV of the project

$$= -\$100m + \frac{(\$140m)(0.55) + (\$40m)(0.45)}{(1.08)^1} = -\$12.04m$$



Net Present Value Approach

Ignores flexibility in investment such as reversibility and scalability in the evaluation horizon (忽略投资的灵活性，如评估范围内的可逆性和可伸缩性)

- Value of IT investment may arise from the flexibility in the investment
- Tends of undervalue a project’ s worth and is not suitable for high-risk projects

Simple cash profits are not the only value a project can add

- Other opportunities may arise from engaging in projects
- E.g., the project gives management the option to
- Abandon a project that is operating at a loss and sell or redeploy the assets (option to abandon/switch)
- Scale back project that is operating at a loss (option to contract)
- Wait/learn more to see if a project will be profitable (option to defer/postpone)
- Expand/scale up the project based on its success (option to expand)
- Real option approach allows management to quantify these options

Real Option Approach:

The company could start with a pilot project and better learn the market over time.

In the following year, management could avoid full investment of $100m into this smart vending machine technology if the market turns out to be $40m, and only invest in this technology if the market turns out to be $140m

Option value of the pilot project

$$= \frac{(\$140m - \$100m)(0.55) + (\$0m)(0.45)}{(1.08)^1} = \frac{\$22m}{(1.08)^1} = \$20.37m$$

So, as long as the pilot project costs less than $20.37m, this pilot project with a following investment in the smart vending machine technology is worth doing

Presenting the Business Case:

Know the audience:

Different stakeholders hold very different perspectives about what and how an IS investment should be made.

A number of factors come into play in making investment decisions, and numerous outcomes can occur.

Convert benefits to monetary terms:

Translate all potential benefits into monetary savings (annual savings)

Devise proxy variables:

In some cases it is not easy to quantify the impact of an investment

Alternative measures of outcomes to help clarify the impact on the firm

- Measure changes in terms of perceived value to the organization
- E.g., More direct contact with customers while reducing administrative workload

Measure that is important to management:

- Focus on the "hot-button" issues and how the system impacts them
- E.g., Cycle time, regulatory or compliance issues, customer feedback, employee morale, etc.

IS Development and Acquisition Strategy

In house Development

- System Development Life Cycle (SDLC)
- Alternative Methods and Tools: Prototyping / Joint Application Design (JAD) / Integrated Computer-Assisted Software Engineering (CASE) / Rapid Application Design (RSD) / Agile development (Extreme Programming) / End-User Development / Object-Oriented Development

External Acquisition

Custom vs Off-the-shelf Software / Open Source Software / Outsourcing

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1. Traditional Systems Development Life Cycle (SDLC)

(1) The traditional systems development method that organizations use for large-scale IT projects

(2) A structured framework that consists of sequential processes by which information systems are developed

- Systems investigation
- Systems analysis
- Systems design
- Systems implementation
- Systems maintenance

2. Alternative Methods and Tools

(1) Joint Application Design (JAD): A group-based tool for collecting user requirements and creating system designs

(2) Prototyping: An approach that defines an initial list of user requirements, builds a model (prototype) of the system, and then refines the systems in several iterations based on users' feedback

(3) Computer-Aided Software Engineering (CASE): A group of tools that automate many of the tasks in the SDLC
- Upper CASE tools: automate early stages of the SDLC
- Lower CASE tools: automate later stages of the SDLC
(4) Rapid Application Development (RAD): A systems development method that combine JAD, prototyping, and integrated CASE tools to rapidly produce a high-quality system
(5) Agile Development: A software development methodology that delivers functionality in rapid iterations, which are usually measured in weeks, requiring frequent communication, development, testing, delivery- E.g., Extreme Programming (XP): A software development methodology that centers around fast software release to customers, small development teams (usually pairs), and extensive code reviews and testing
(6) End-User Development: An approach in which the organization's end users develop their own applications with assistance from the IT department
(7) Object-Oriented Development: A systems development methodology that begins with aspects of the real world that must be modeled to perform a task

3. External Acquisition

(1) Systems investigation
(2) Systems analysis
(3) Development of a request for proposal (RFP): A document that is used to tell vendors what your requirements are and to invite them to provide information about how they might be able to meet those requirements
- A summary of existing systems and applications
- Requirements for system performance and features
- Reliability, backup, and service requirements
- The criteria that will be used to evaluate proposals
- Timetable and budget constraints
(4) Proposal evaluation
(5) Vendor selection

4. Custom vs. Off-the-Shelf Software

(1) Custom Software

- Customizability: tailored to meet unique organizational requirements
- Problem specificity: pays only for features specifically required for its users

(2) Off-the-Shelf Software

- Typically used for supporting business processes that do not require any specific tailoring
- Generally, less costly, faster to procure, higher quality, less risky than custom systems

5. Free Software

(1) Software that comes with permission for anyone to use, copy, and/or distribute, either verbatim or with modifications, either gratis or for a fee

(2) Not free-download software

(3) Free as in "free speech", not as in "free beer"

- The freedom to run the program, for any purpose (freedom 0).
- The freedom to study how the program works, and change it so it does your computing as you wish (freedom1): Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3).

(4) Open source software

- Software that can be freely used, changed, and shared (in modified or unmodified form) by anyone
- Nearly the same as free software

(5) Public domain software

- Software that is not copyrighted
- With or without source code

(6) Copylefted software

- Free software whose distribution terms (copyrights) ensure that all copies of all versions carry more or less the same distribution terms
- E.g., Software under GPL (GNU General Public License)
- Use copyrights to shield the program, and its modified versions, from some of the common ways of making a program proprietary

6. Outsourcing

(1) Outsourcing

- Use of outside contractors or external organizations to acquire IT services
- Contracting out a business process (e.g., software development, call center operation) to a third-party

(2) Offshoring

- Relocating business process from one country to another (e.g., India and China)

7. Why Outsourcing?

(1) Cost and Quality Concerns
- Higher quality systems as a lower price

(2) Problems in IS Performance
- Increase reliability through outsourcing

(3) Supplier Pressure
- The largest service providers are often the largest suppliers of computer equipment

(4) Simplifying, Downsizing, and Reengineering
- Focus on only the "core competencies"

(5) Financial Factors
- Strengthen the balance sheets by liquidating IT assets; use IT services more wisely

(6) Organizational Culture
- External service provider often bring enough clout to streamline IS operations as needed

(7) Internal Irritants
- Eliminate tension between end users and the IS staff

11.1. What is the Productivity Paradox of IT?

Vast expenditures on IT have not led to measurable productivity gains

-Real purchases of computers continue to rise / -Productivity in the service sector has not kept pace with that in manufacturing

11.2. What are the explanations for the paradox?

(1) Measurement. (2) Time lags. (3). Redistribution. (4). Mismanagement

11.3. Which explanation appears to account for the biggest share of the paradox? -- Mismeasurement of inputs and outputs

Outputs (and inputs) of information-using industries are not being properly
measured by conventional approaches

Output Mismeasurement: Increased quality change, variety, customer service, speed and responsiveness

11.4. Which explanations point to shortcomings in research?

(1). Mismeasurement of outputs and inputs. (2). Time Lags due to learning and adjustment.

11.5. Which explanations point to shortcomings in practice?

(1). Redistribution and dissipation of profits. (2). Mismanagement of information and technology.

11.6. Explain how the example of investment in ATMs by banks contributes to the IT productivity paradox.

Convenience afforded by 24h ATMs / It leads to fewer checks being written

11.7. Explain how the computer price deflator used in the government statistics contributes to the IT productivity paradox in the service (computer-using) industries. / How to measure IT stock

- Decline in the computer price deflator was overstated

(1) "Real" quantity of computers purchased recently (20 years ago) should be lower (higher)

(2) Productivity improvement attributed to computer producing industry should be allocated to computer-using industry

11.8. Explain the time lags argument for the IT productivity paradox

› **Time lags due to learning and adjustment:** Time lags in the payoffs to IT make analysis of current costs vs. current benefits misleading

(1) Two-to-three years before the strongest organizational impacts were felt
(2) As much as five years to pay off

11.9. Explain the renting dissipating property of information, and how it explains the IT productivity paradox at the industry level.

(1) IT is used in redistributive activities among firms, making it privately beneficial without adding to total output: Information is particularly vulnerable to rent dissipation (one firm' s gain comes entirely at the
expense of others)
(2) Only explain shortfall in IT productivity at the industry level but not at the firm level
- Firms with inadequate IT budgets lose market shares and profits to high IT spenders
- Strategic information systems take profits from competitors rather than lower costs

11.10. Explain the mismanagement argument for the shortfall in IT productivity at the firm level.

(1) The lack of explicit measures of the value of information makes it particularly vulnerable to misallocation and overconsumption by managers: Increasing organization slacks instead of outputs or profits, building inefficient systems, using outdated criteria for decision making
(2) IT is really not productive at the firm level

Chapter 12 IS Security Management

Primary Threats to IS Security

(1) Natural Disasters: Power outages, hurricanes, flood, etc.
(2) Accidents: Inexperienced or careless computer operators
(3) Employees & Consultants: People within an organization who have access to electronic files
(4) Links to Outside Business Associates: Electronic information that can be at risk when it travels between or among business affiliates as part of doing business
(5) Outsiders: Hackers and crackers who penetrate networks and computer systems to snoop or to cause damages (including viruses)

IS Security: Precautions taken to keep all aspects of information systems safe from destruction, manipulation, or unauthorized use or access, while providing the intended functionality to legitimate users

Organizational considerations: Availability (Ensuring that legitimate users can access the systems) **/ Integrity** (Ensuring that unauthorized manipulations of data and systems are prevented) **/ Confidentiality** (Ensuring that data are protected from unauthorized access) **/**

Accountability (Ensuring that actions can be traced)
An ongoing process consisting of: Assessing Risks / Developing a security strategy / Implementing controls and training / Monitoring security
IS security is a management issue, not a technology issue.
IS Risk Assessment 信息系统风险评估:
(1) Obtain an understanding of the risks to the availability, integrity, and confidentiality of data and systems
(2) Should encompass all of an organization' s systems, so as to identify **threats** and **vulnerabilities**, determine their probabilities of being exploited, and to assess the potential **impact**
- Threats: Undesirable events that can cause harm
- Vulnerabilities: Weaknesses in an organization' s systems or security policies that can be exploited to cause damage
- Impacts: The severity of the consequences if a threat indeed causes damage by exploiting a vulnerability
(3) Ensure that IS security programs make sense economically: Assess the value of the assets being protected / - Determine their probability of being compromised / Compare the probable costs of assets being compromised with the estimated costs of protections
(4) Uses both quantitative data (e.g., value of the asset and implementation costs of security measures) and qualitative data (e.g., results from interviews and walkthroughs) to arrive at a risk rating for each particular function or asset
Risk Mitigation Options: reduction / acceptance / transference / avoidance
Development a Security Strategy
(1) Once risks are assessed, a strategy should be formulated that details what IS controls (technology, people, policies, etc.) should be implemented
- Preventive Controls: Prevent potentially negative event from occurring
- E.g., authentication controls, encryption, etc.
- Detective Controls: Assess whether anything went wrong
- E.g., intrusion detection systems, security testing, etc.
- Corrective Controls: Mitigate the impact of any problem after it has arisen
- E.g., Computer emergency response team (CERT), patch management, etc.
(2) Balance between implementing preventive measures and providing functionality for the users
- Principle of Least Privileges (POLP): Users should only be given access that are needed to perform their duties
(3) Defense-in-Depth: Employ multiple layers of controls in order to avoid having a single point of failure
Time-based Model of Security

Evaluates the effectiveness of an organization’ s security

- P(t) = Time it takes an attacker to break through the organization’ s preventive controls
- D(t) = Time it takes to detect that an attack is in progress
- C(t) = Time it takes to respond to the attack

- If P(t) > D(t) + C(t), then the organization’ s security procedures are effective

Implementing Controls and Training

(1) Once a comprehensive strategy has been formulated, organizations can decide which controls to implement and train personnel regarding security policies and measures

(2) Commonly used controls

Access restrictions / Encryption / Firewalls / Virus monitoring and prevention / Secure data centers / Mobile device management / Systems development controls / Human controls

Access Restrictions

(1) Authentication

- Process to determine the identity of the person requiring access

(2) Factors of Authentication

- Something You Know (Knowledge Factor) E.g., password, PIN, pattern
- Something You Have (Ownership Factor)

E.g., smart card, mobile phone, security token

- Something You Are (Inherence Factor)

E.g., biometrics (fingerprints, voice patterns, facial characteristics)

(3) Two-factor (multiple-factor) Authentication: Involves two (or more) of the authentication factors

(4) CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart / Test to determine whether the user is human

Encryption

(1) The process of converting an original message (plaintext) into a form that cannot be read (ciphertext) by anyone except the intended receiver

(2) Objectives

- Confidentiality: The message is readable only by the person for whom it is intended
- Integrity: The message that was sent is the same message that is received
- Authentication: The sender of the message is who she claims to be

- Nonrepudiation: Proof that the sender actually sent the message / Prohibits the author of the message from falsely denying that he sent the message

(3) Symmetric key algorithm: Same key for both encryption of plaintext and decryption of ciphertext

(4) Asymmetric (public) key algorithm: Public key and private key

Symmetric Key Algorithm

Digital Signature

(1) A mathematical scheme for demonstrating the authenticity of a digital message or document

(2) Gives a recipient reason to believe the message was created by a known Sender, such that: The sender cannot deny having sent the message (authentication and nonrepudiation) / The message was not altered in transit (integrity)

(3) Employs asymmetric key algorithms: Symmetric key algorithms?

Digital Certificate

(1) An electronic document that uses a digital signature to bind a public key with an identity

- Owner's public key
- Owner's name or alias
- Expiration date of the certificate
- Serial number of the certificate
- Name of the organization that issued the certificate
- Digital signature of the organization that issued the certificate

(2) Certificate Authority (CA)

- A trusted third party that issues digital certificates
- Uses its own digital signature to bind a public key with an identity

Secure Socket Layer (SSL): An encryption standard used for secure transactions such as credit card purchases and online banking. / Now succeeded by Transport Layer Security (TLS)

Virtual Private Network (VPN): A private network that uses a public network (usually the Internet) to securely connect users by using encryption

It looks like tunneling: A process that encrypts each data packet to be sent and places each encrypted packet inside another packet

IS Security Policies and Procedures: Some of the best things to secure information systems are not necessarily technical in nature

(1) Information Policy: Outlines how sensitive information will be handled, stored, transmitted, and destroyed

(2) Security Policy: Explains technical controls on all organizational computer systems
(3) Use Policy: Outlines the organization' s policy regarding appropriate use of in-house computer systems
(4) Backup Policy: Explains requirements for backing up information
(5) Account Management Policy: Lists procedures for adding and removing users to systems
(6) Incident Handling Procedures: Lists procedures to follow when handling a security breach
(7) Business Continuity Plan: Describes how a business continues operating after a disaster, before normal operations have been restored
(8) Disaster Recovery Plan: Subset of the business continuity plan / Spells out detailed procedures for recovering from systems-related disasters (e.g., virus infections)
Monitoring Security: Organizations should continuously monitor the effectiveness of the controls
(1) Monitoring external events: - Information Sharing and Analysis Centers (ISAC) / - Computer Emergency Readiness Team (CERT)
(2) IS auditing: - Often performed by external auditors / - Help organizations assess the state of their IS controls; ensure IS availability, integrity, and confidentiality; and determine necessary changes / - Control Objectives for Information and related Technology (COBIT)
- A framework created by IS Audit and Control Association (ISACA) for IT
management and governance
- A set of best practices that helps organizations both maximize the benefits from there is infrastructure and establish appropriate controls