Computer and Information Systems

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Lecture 3

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Hardware and Software
Chapter 3

Figure 3-10 Contemporary Operating Systems

Name	Principal Use	Principal Proponent	Instruction Set
Windows	Business users Servers	Microsoft	Intel
Macintosh	Graphic artists Arts community	Apple	Power PC (as of 2006, also Intel)
Unix	Scientists Engineers	Sun Microsystems and others	Many
Linux	Servers Scientists Engineers	IBM	Many

Mac OS

- **Apple Computer, Inc.** developed its own operating system for the Macintosh, **Mac OS**.

- Macintosh computers are used primarily by graphic artists and workers in the arts community.

- As of 2006, Macintosh computers will be available for both PowerPC and Intel CPUs.

- A Macintosh with an Intel processor is able to run both Windows and the MAC OS.

Unix OS

- **Unix** is an operating system that was developed at Bell Labs in the 1970s.

- It has been the workhorse of the scientific and engineering communities since then.

- Unix is generally regarded as being more difficult to use than either Windows or the Macintosh.

- Many Unix users know and employ an arcane language for manipulating files and data.

- In general, Unix is not for the business user.

Linux OS

- **Linux** is a version of Unix that was developed by the **open-source community.**

- This community is a loosely coupled group of programmers who mostly volunteer their time to contribute code to develop and maintain Linux.

- The open source community owns Linux, and there is no fee to use it.

- Linux is a popular operating system for Web servers.

Application Software (1)

- **Application software** consists of programs that perform a business function.

- Some application programs are general purpose, such as Excel or Word.

- Other application programs are specific
  - QuickBooks, for example, is an application program that provides general ledger, and other accounting functions.

Application Software (2)

Sources

- You can buy computer software several ways:
  - Off-the-shelf
  - Off-the-shelf with alterations
  - Tailor made

Horizontal-Market Applications Software

- Horizontal-market application software provides capabilities common across all organizations and industries.
- Word processor, graphics programs, spreadsheets, and all presentation programs are all horizontal-market application software.

Application Software (3)

Vertical-Market Applications Software

- Vertical-market application software serves the needs of a specific industry.

- Examples of such programs are:
  - Those used by dental offices to schedule appointments and bill patients
  - Those used by auto mechanics to keep track of customer data and customers' automobile repairs
  - Those used by parts warehouses to track inventory, purchases, and sales

Application Software (4)

Custom-Developed Software

- Sometimes organizations develop custom application software.

- They develop such programs themselves or hire a development vendor.

- Custom development is difficult and risky.

- Every application program needs to be adapted to changing needs and changing technologies .

Figure 3-11 Software Sources and Types

	Software Source		
Software Type	Off-the-shelf	Off-the-shelf and then customized	Tailor-made
Horizontal applications			
Vertical applications			
Custom applications			

Firmware

- **Firmware** is computer software that is installed into devices like printers, print servers, and various types of communication devices.

- The software is coded just like other software, but it is installed into special, read-only memory of the printer or other device.

- Users do not need to load firmware into device's memory.

- Firmware can be changed or upgraded, but this is normally a task for IS professionals.

Problem Solving Guide–Questioning your Questions

- For most problems, in the business world, the difficult and creative acts are generating the questions and formulating a strategy for getting the answers.

- Once the questions and strategy are set, the rest is simply legwork.

- As a future consumer of information technology and services, you will benefit from being able to ask good questions and effectively obtain answers to them.

Problem Solving Guide–Questioning your Questions (2)

- It is probably the single most important behavior you can learn.

- There are billions of bad questions, and you will be better off if you learn not to ask them.

- Questions can be bad in three ways:
  - They can be irrelevant
  - Dead
  - Asked of the wrong source

Problem Solving Guide–Questioning your Questions (3)

- A dead question is one that leads to nowhere, it provides no insight into the subject.
  - Example–"Is the material on how a computer works going to be on the test?
  - The answer will help you in school, but it won't help you use MIS on the job.
  - Instead ask questions like,
    - "What is the purpose of the section on how a computer works?"
    - '"Why are we studying it?"
    - "How will it help me use MIS in my career?"

Problem Solving Guide–Questioning your Questions

- Information technology questions fall into three categories:
  - "What is it?"
  - "How can I use it?"
  - "Is it the best choice?"

Security Guide–Viruses, Trojan Horses, and Worms

- A virus is a computer program that replicates itself and consumes the computer's resources.

- The program code that causes unwanted activity is called the **payload.**

- There are many different virus types:
  - Trojan horses
  - Macro viruses
  - Worm

Security Guide–Viruses, Trojan Horses, and Worms (2)

- Prevention steps are:
  - Find and apply patches to the operating system and to applications.
  - Never download files, programs, or attachments from unknown Web sites.
  - Do not open attachments to emails from strangers.
  - Do not open unexpected attachments to emails, even from known sources.
  - Do not rely on file extensions.
  - Run a retroactive antivirus program at regular intervals, at least once per week.

Reflection Guide–Keeping Up to Speed (1)

- Technology change is a fact, and the only appropriate question is, "What am I going to do about it?"
  - One strategy you can take is to bury your head in the sand: "Look, I'm not a technology person. I'll leave it to the pros. As long as I can send email and use the Internet, I'm happy."
  - This strategy is fine, as far as it goes, and many business people use it. However, it won't give you a competitive advantage over anyone, and it will give someone else a competitive advantage over you.

Reflection Guide–Keeping Up to Speed (2)

- At the other end of the spectrum, are those who are not only knowledgeable in their field, but also enjoy information technology.
  - These people are sprinting along the technology conveyor belt; they will never end up in the techno-trash, and they will use their knowledge of IT to gain competitive advantage throughout their careers.

- Many business professionals are in between these extremes.

Reflection Guide–Keeping Up to Speed (3)

- There are a couple of strategies:
  - Don't allow yourself to ignore technology.
  - Take a seminar or pay attention to professional events that combine your specialty with technology.
  - Get involved in as a user in your organization.
  - Later in your career, become a member of the business practice technology committee, or whatever they call it at your organization.

Top MBA Employers

- http://money.cnn.com/magazines/fortune/mba100/2008/full_list/

- http://money.cnn.com/magazines/fortune/mba100/2008/maps/state/NY.html

Chapter 4 – Database Processing

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Purpose of a Database

- The purpose of a database is to keep track of things that involve more than one theme.

Figure 4-1 A List of Student Grades

Figure 4-2 Student Data Shown in Form from Database

What Is a Database?

- A **database** is a self-describing collection of integrated records.

- A byte is a character of data.

- Bytes are grouped into **columns**, such as *Student Number* and *Student Name.*

- Columns are also called **fields.**

What Is a Database? (Continued)

- Columns or fields, in turn, are grouped into **rows**, which are also called **records.**

- There is a hierarchy of data elements.

- A database is a collection of tables *plus* relationships among the rows in those tables, *plus* special data, called metadata.

- Metadata describes the structure of the database.
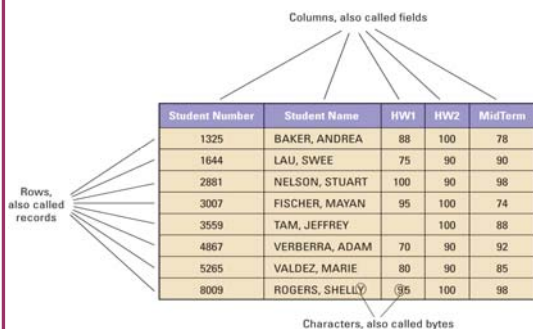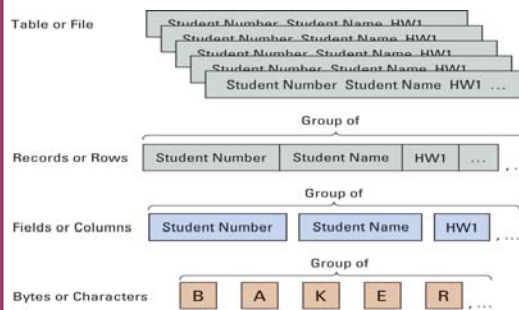
Figure 4-3 Student Table (also called File)

Figure 4-4 Hierarchy of Data Elements

Relationships Among Records

- A **key** is a column or group of columns that identifies a unique row in a table.
  - *Student Number* is the key of the Student table.

- A **foreign key** is a non-key column or field in one table that links to a primary key in another table.
  - *Student Number* in the *Email* and *Office_Visit* tables

- Relational databases store their data in the form of tables that represent relationships using foreign keys.
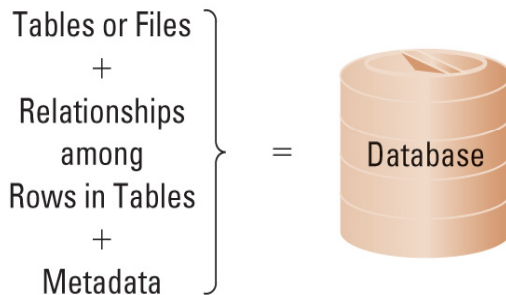
Figure 4-5 Components of a Database

Tables or Files
+
Relationships among Rows in Tables
+
Metadata

= Database

Figure 4-6 Examples of Relationships Among Rows

Metadata

- Databases are self-describing because they contain not only data, but also data about the data in the database

- Metadata are data that describe data.

- Field properties describe formats, a default value for Microsoft Access to supply when a new row is created, and the constraint that a value is required for the column.

- The presence of metadata makes databases much more useful.

- Because of metadata, no one needs to guess, remember, or even record what is in the database.

- Metadata make databases easy to use for both authorized and unauthorized purposes.

Figure 4-7 Example Metadata (in Access)

Components of a Database Application System

- By itself database, is not very useful.

- Pure database data are correct, but in raw form they are not pertinent or useful.

- Database applications make database data more accessible and useful.

- Users employ a database application that consists of forms, formatted reports, queries, and application programs.

- Each of these, in turn, calls on the database management system (DBMS) to process the database tables.

Figure 4-8 Components of a Database Application System
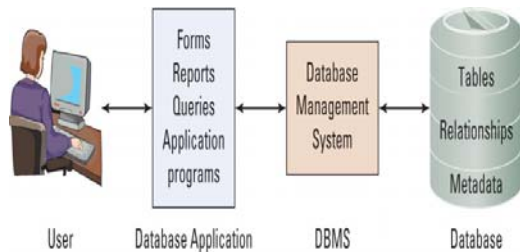
Database Management System

- A **database management system (DBMS)** is a program used to create, process, and administer a database.
- Almost no organization develops its own DBMS.
- Companies license DBMS products from vendors like IBM, Microsoft, Oracle, and others.

Database Management System (Continued)

- Popular DBMS products are:
  - **DB2** from IBM
  - **Access** and **SQL Server** from Microsoft
  - **MySQL,** an open-source DBMS product that is free for most applications
- The DBMS and the database are two different things:
  - A DBMS is a software program.
  - A database is a collection of tables, relationships, and metadata.

Processing the Database

- The second function of the DBMS is to process the database.
- Applications use the DBMS for four operations: *read, insert, modify,* or *delete* data.
- The applications call upon the DBMS in different ways:
  - Via a form, when the user enters new or changed data
  - Via a computer program behind the form calls the DBMS to make the necessary database changes
  - Via an application program, the program calls the DBMS directly to make the change

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Processing the Database (Continued)

- **Structured Query Language (SQL)** is an international standard language for processing a database.
- All five of the DBMS products mentioned earlier accept and process SQL statements.
- SQL can be used to create databases and database structures.

Administering the Databases

- A third DBMS function is to provide tools in the administration of the database.
- Database administration involves a wide variety of activities.
  - For example, the DBMS can be used to set up a security system involving user accounts, passwords, permissions, and limits for processing the database
  - DBMS administrative functions also include:
    - Backing up database data
    - Adding structures to improve the performance of database applications
    - Removing data that are no longer wanted or needed, and similar tasks

Database Applications

- A **database application** is a collection of forms, reports, queries, and application programs that process a database.

- A database may have one or more applications, and each application may have one or more users.

- Applications have different purposes, features, and functions, but they all process the same inventory data stored in a common database.

Figure 4-10 Use of Multiple Database Applications
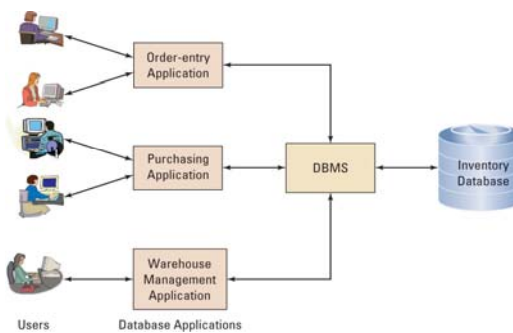
Forms, Reports, and Queries

- Data entry forms are used to read, insert, modify, and delete data.

- Reports show data in a structured content.
  - Some reports also compute values as they present the data.

- DBMS programs provide comprehensive and robust features for querying database data.

Figure 4-11 Example Student Report

Figure 4-12 Example Query

Database Application Programs

- Application programs process logic that is specific to a given business need.

- Application programs enable database processing over the Internet.
  - For this use, the application program serves as an intermediary between the Web server and the database.
  - The application program responds to events, such as when a user presses a submit button; it also reads; inserts; modifies; and deletes database data.

Figure 4-13 Four Application Programs on Web Server Computer
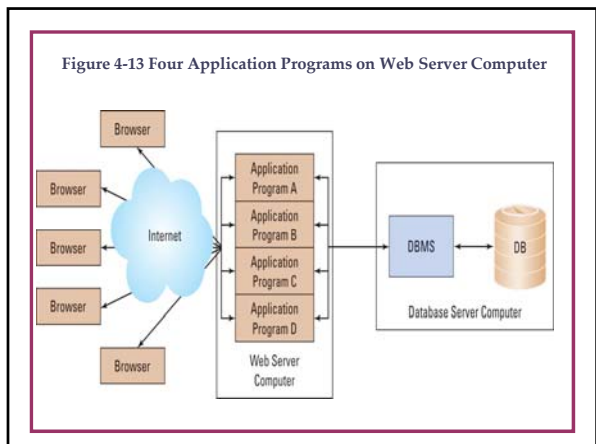
Enterprise DBMS Versus Personal DBMS

- DBMS products fall into two broad categories: **Enterprise DBMS** and **Personal DBMS.**

Enterprise DBMS
  - These products process large organizational and workgroup databases.
  - These products support many users, perhaps thousands, of users and many different database applications.
  - Such DBMS products support 24/7 operations and can manage dozens of different magnetic disks with hundreds of gigabytes or more data.
  - IBM's DB2, Microsoft's SQL Server, and Oracle are examples of enterprise DBMS products.

Enterprise DBMS Versus Personal DBMS (Continued)

Personal DBMS
  - These products are designed for smaller, simpler database applications.
  - Such products are used for personal or small workgroup applications that involve fewer than 100 users, and normally fewer than 15.
  - The great bulk of databases in this category have only a single user.
  - Microsoft Access is the only available personal DBMS.

Figure 4-14 Personal Database System
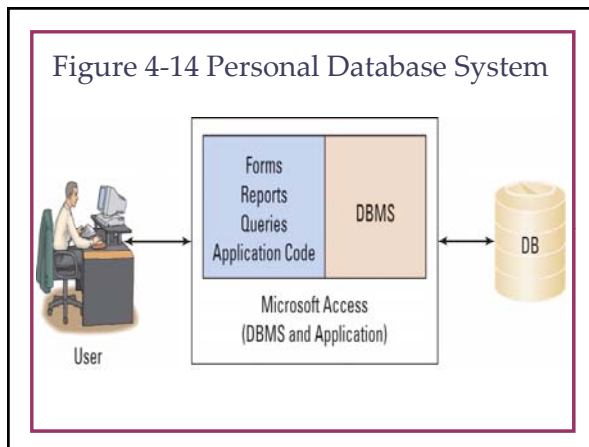
Developing a Database Application

- The reason that user involvement is so important for database development is that the database design depends entirely on how users view their business environment.

- Database structures can be complex, in some cases, very complex.

- Before building, the database, the developers construct a logical representation of database data called a **data model.**

- The data model describes the data and relationships that will be stored in the database.

Figure 4-15 Database Development Process
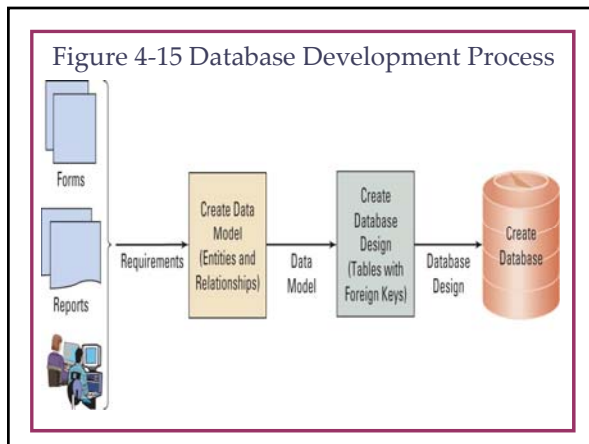
Importance of User's Review

- Users are the final judges as to what data the database should contain and how records in the database should be related to one another.

- The easiest time to change the database structure is during the data modeling stage.

- However, once the database has been constructed, loaded with data, and application forms, reports, queries, and application programs created, changing a relationship means weeks of work.

Importance of User's Review (Continued)

- When a database is developed for your use, you must carefully review the data model.

- If you do not understand any aspect of it, you should ask for clarification until you do.

- The data model must accurately reflect your view of the business.

- Do not proceed unless the data model is correct.

Database Administration

- In light of both the importance and the management challenges of databases, most organizations have created a staff function called **database administration.**

- In smaller organizations, this function is usually served by a single person, sometimes even on a part-time basis.

- Larger organizations assign several people to an office of database administration.

Database Administration (Continued)

- Depending on the context, the letters **DBA** either stand for the *database administrator* or for the *office of database administration.*

- The purpose of database administration is to manage the development, operation, and maintenance of a database so as to achieve the organization's objectives.

- This function requires balancing conflicting goals: protecting the database while maximizing its availability for authorized use.

Figure 4-26 Summary of Database Administrative Tasks

Category	Database Administration Task	Description
Development	Create and staff DBA function	Size of DBA group depends on size and complexity of database. Groups range from one part-time person to small group.
	Form steering committee	Consists of representatives of all user groups. Forum for community-wide discussions and decisions.
	Specify requirements	Ensure that all appropriate user input is considered.
	Validate data model	Check data model for accuracy and completeness.
	Evaluate application design	Verify that all necessary forms, reports, queries, and applications are developed. Validate design and usability of application components.
Operation	Manage processing rights and responsibilities	Determine processing rights/restrictions on each table and column.
	Manage security	Add and delete users and user groups as necessary; ensure that security system works.
	Track problems and manage resolution	Develop system to record and manage resolution of problems.
	Monitor database performance	Provide expertise/solutions for performance improvements.
	Manage DBMS	Evaluate new features and functions.
Backup and Recovery	Monitor backup procedures	Verify that database backup procedures are followed.
	Conduct training	Ensure that users and operations personnel know and understand recovery procedures.
	Manage recovery	Manage recovery process.
Adaptation	Set up request tracking system	Develop system to record and prioritize requests for change.
	Manage configuration change	Manage impact of database structure changes on applications and users.

DBA Development Responsibilities

- The DBA is not a user of the database or any of its applications.

- The DBA is an auditor, a consultant, sometimes a policeman, and a diplomat who works as a liaison between the users and professional developers.

- One of the first tasks for the DBA is to create a steering committee that consists of key users.

- The DBA uses the committee as a forum for community-wide decisions regarding the development, use, and maintenance of the database.

DBA Backup and Recovery Responsibilities

- As a protector of the database, the DBA has the responsibility to ensure that appropriate procedures and policies exist for backing up the database and that those procedures are followed.

- The DBA needs to ensure that users and operations personnel are appropriately trained with regard to backup and recovery procedures.

- Finally when failures occur, in many organizations the DBA is responsible for managing the recovery process.

DBA Responsibilities for Adaptation

- Over time, requirements for the database will change.

- Changes that benefit one group in the organization may not benefit other groups.

- The DBA needs to set up a system for recording and tracking requests for changes.

- The responsibility of the DBA is to provide the forum and to ensure that requests are considered and acted upon in a responsible manner.

Is the DBA a Technical Person?

- The DBA function has broad managerial responsibilities for the database.

- Part of the DBA function is technical:
  - Monitoring performance
  - Managing the DBMS
  - Developing backup and recovery procedures

- For larger organizations, and for databases that touch many different departments and business functions, the DBA's job is more diplomatic than technical.
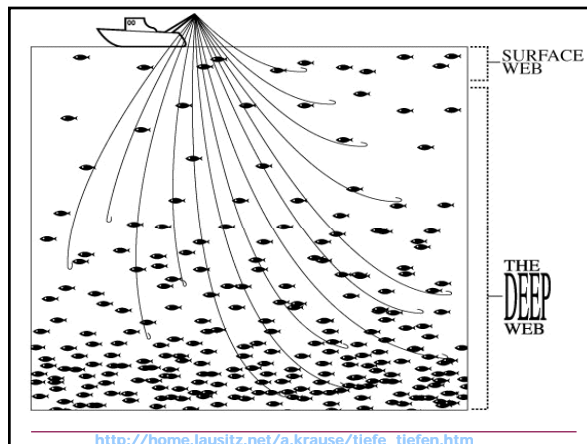
"Deep" or "Invisible" Web

- Search engines can't or won't search
- Dynamically generated pages [cgi, asp, cfm, URL with ?]
  - Weather, news, job postings, market prices, available airline flights etc.
- Web accessible databases
  - Laws, dictionaries, lists of professionals such as Drs or lawyers, calculators
- Password or login required
- Certain file formats [e.g. PDF, streaming media, etc]
- A lot of the real time data [stock quotes, sports scores, election results etc]
- Commercial resources with domain or IP limitations
- Information residing on an Intranet
- Archives [newspapers]

Deep Web

- Data that lies in backend databases that are only accessible through HTML forms

- Big g[...] [...]erage o[...] [...]nes

- Exten[...] [...] the pa[...]
  - Ma[...] even *ten*[...] [...] data sources cov[...] [...]us doma[...]

http://home.lausitz.net/a.krause/tiefe_tiefen.htm

SURFACE WEB

THE DEEP WEB

Security Guide–Database Security

- The firewall, a computing device located between a firm's internal network and external networks, prevents unauthorized access to the internal network.

- For the best security, the DBMS computer should be protected by a firewall, and then all other security measures should be designed as if the firewall has been breached.

Security Guide–Database Security (Continued)

- All operating systems and DBMS patches should be installed as soon as they become available.

- To prevent unauthorized access, no one other than authorized operations personnel should be able to directly access the computer that runs the DBMS.
  - Instead, all access should be via authorized applications programs

- The computer running the DBMS should be secured behind locked doors, and visits to that room should be recorded in a log.

Security Guide–Database Security (Continued)

- All major DBMS products have extensive, built-in security features.
  - These features allow for the definition of **user accounts** and **user roles.**
  - Each user account belongs to a specific person.
  - A role is a generic employee function, such as payroll clerk or field salesperson.
  - Once an account is defined, it can be assigned specific permissions, and it can also be assigned particular roles.

- Most DBMS products log failed attempts to sign on and produce other usage reports as well.

Security Guide–Database Security (Continued)

- The database administrator (DBA) should periodically monitor such logs and reports for suspicious activity.

- It is important to have a plan of action for security emergencies.

- The steps to be taken vary from database to database.

Opposing Forces Guide–No, Thanks, I'll Use a Spreadsheet

- I'm not buying all this stuff about databases.
  - "I've tried them and they're a pain-way too complicated to set up, and most of the time, a spreadsheet works just as well."
  - "No, unless you are a General Motors or Toyota, I wouldn't mess with a database."
  - "You have to have professional IS people to create it and keep it running."
  - "Besides, I don't really want to share my data with anyone."
  - "I work pretty hard to develop my client list."
  - "Why would I want to give it away?"
  - "When I want something, I use Excel's Data Filter."
  - "I can usually get what I need."
  - "Of course, I can't still send form letters, but it really doesn't matter."
  - "I get most of my sales using the phone, anyway."

Reflection Guide–Requirements Creep (Continued)

- It is very important for user involvement in both requirements specification and data model validation.

- Unfortunately, however, not all change requests are preventable.
  - Some occur only after a period of system use.

- An information system enables its users to behave in new ways, and as they behave in new ways, they think of new requirements for the system.

Reflection Guide–Requirements Creep (Continued)

- As the system is adapted to add new features, the users again will be able to behave in new ways, and they will then think of yet additional features and functions.

- The bottom line is there will always be new requirements for an information system.

- The users and the development team must specify all the requirements that they know about and validate the data model as best they can.